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THE CONNECTION
BETWEEN
THOUGHT AND MEMORY

*A CONTRIBUTION TO PEDAGOGICAL PSYCHOLOGY
ON THE BASIS OF F. W. DÖRPFELD'S MONO-
GRAPH "DENKEN UND GEDÄCHTNIS"*

WITH AN INTRODUCTION BY
G. STANLEY HALL, LL.D.
President of Clark University

BY
HERMAN T. LUKENS, PH.D.
DOCENT IN CLARK UNIVERSITY

BOSTON, U.S.A.
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PREFACE.

* A SHORT time ago a teacher complained to the author that she could not get any real help in her school-work from reading psychologies and books on education. It is hoped that the following book will give help to such teachers, not only by the central idea that stands out so prominently, but by its copious illustrations and descriptions of mental phenomena, as well as by the practical applications in the last chapters. The teacher needs *descriptive psychology* far more than metaphysical psychology.

Even a few simple exercises, such as those recommended on page 5 for grammar school pupils, would greatly help teachers toward appreciating the character of the mental processes with which they have to deal. Observation work thus begun will be found so interesting and attractive that it will easily lead to further introspection and study of the laws of association (cf. pp. 41, 42). But still more help will be gained if teachers will watch how their own pupils think and reason. Make notes of the observations, and compare them with such records as those reported in the *Pedagogical Seminary*, vol. ii. pp. 358-396.

There is nothing in all of this that any bright teacher cannot readily understand. But the mistake is too frequently made of supposing that whatever the teacher learns she must forthwith tell her pupils. Nothing could

be more fatal to good teaching than to attempt to *make* the child think logically, or learn lessons by the Herbartian formal steps. But every teacher should know how children *do* think, and what the necessary steps in acquiring knowledge really are, so as to be able to get out of the way and not hinder the pupil's progress, as well as to be able when necessary to give just the help that is needed.

The monograph treatment is eminently adapted to a work of this kind. Two of the most helpful and suggestive books for teachers are already published in this form: Radestock's *Habit and Its Importance in Education*, and Lange's *Apperception*. It is earnestly hoped that others will follow. Until the chief points in school-work are thus treated, we cannot expect any firm basis for a general work, nor would the teachers get much assistance from such general reading. For self-instruction, the teacher needs *clearness*, *fulness*, and *practical applications*. These are the qualities aimed at in a monograph.

The German monograph on which the following work is based grew out of round-table conferences in a teachers' reading circle formed for the purpose of study in educational psychology. In writing a book for American teachers I have tried to keep true to the best ideals in the German, while at the same time being perfectly free to add to, omit, or modify, any statement or ideas whatever. When I visited Rector Dörpfeld in 1890, to talk over these and other matters with him, he not only gave me full permission to translate his work, but urged me to make any changes and additions I saw fit. Thus it has come to pass

that this work, while quoting very largely from Dörpfeld's, and being based on it so far as its essential central idea is concerned, is yet in no strict sense a translation. Whenever better ideas have been found elsewhere, they have been unhesitatingly substituted. The explanation of the common origin of the two laws of memory, for instance, is radically opposed to the view expressed by Dörpfeld and all other Herbartians. But I do not believe in the Herbartian view on this point, and hence have re-written that part entirely. The same is true of many other less important parts. All of the bibliographical references, and likewise many of the illustrations, are additions.

On the other hand, everything that was essentially German and local in its allusion has been omitted. For the many controversial points with other German educators, and long explanations applicable to religious instruction in Germany only, the reader is referred to the German work. It is now in its fifth edition, in the present issue of the *Collected Works of F. W. Dörpfeld*, 11 vols. Gütersloh ; C. Bertelsmann, 1894-1895. Dörpfeld died in October, 1893.

In conclusion, I wish to thank President G. Stanley Hall and Dr. Wm. H. Burnham for their encouragement and help in the work of revision and of publication. I am also greatly indebted to the following friends: President Charles De Garmo, Dr. C. C. Van Liew, Dr. Charles A. McMurry, and Dr. Frank M. McMurry, for valuable suggestions while the book was passing through the press.

H. T. L.

CLARK UNIVERSITY, June, 1895.



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INTRODUCTION.

DR. HERMAN T. LUKENS, to whom we owe the presentation in so attractive English form of this most noted work of one of the best German teachers of pedagogy, and who as I write has just been advanced in Clark University from the position of Honorary Fellow to Docent, is one of the most accomplished and promising men in that choice group of young Americans who have studied Education in a post-graduate and professional way in Europe and at home, and have deliberately chosen the work of teaching pedagogy as their calling. Unlike too many members of this group, Dr. Lukens, although thoroughly trained in Herbartian pedagogy and in sympathy with it, does not regard it as the consummate formulation of educational theory, nor attempt to apply its rubrics blindly and without change to the very different material and environment of American pedagogy, but has felt it necessary to supplement Herbart, both by modern child-study, and by some practical acquaintance with experimental psychology. It is this that makes Dr. Lukens competent to present us with a condensed digest, instead of a literal translation, and to enrich these pages with copious and valuable notes that render this volume more valuable than the original. This, and many other signs of the times pointing in the same direction, suggests how speedily our country is outgrowing its excessive

reverence for the German speculators of half a century ago. That there are still some to whom it seems the acme of philosophic or pedagogic attainment to interpret the tomes of these great and useful, but now obsolescent, writers is a note of provincialism from which, if all indications do not fail, we are soon to be emancipated.

Save health alone, there is no more important and practical topic for teachers to study than that to which this little book is devoted. Its subject-matter is presented in a clear and elemental manner sure to have speedy fruit in the schoolroom, and it is worthy the attention of all practical teachers, to whom I have no hesitation in recommending it. I cannot forebear laying still more stress than does Rector Dörpfeld on the distinction, not only between immanent and intentional memorizing, but between immanent and intentional thinking. The latter is, of course, chiefly dealt with in books, but the former is incalculably more important; and to know something of the mysterious nature of memory and of thought is one of the chief objects of the new study of children.

G. STANLEY HALL.

CLARK UNIVERSITY,
WORCESTER, MASS., *Sept. 17, 1895.*

THE CONNECTION BETWEEN THOUGHT AND MEMORY.

CHAPTER I.

PRELIMINARY.

THERE are undoubtedly many more books written about the memory than about any other faculty of the human mind. Great power of retention is fascinating to most people and easily appreciated. The "memory doctors" are accordingly numerous, and reap a rich harvest, notwithstanding repeated exposures. Thinking is, however, somewhat more difficult than remembering, and therefore less attractive for most of us. But every educator, at least, is interested in both divisions of our subject, and must come to some conclusion in his own mind as to the relation that these two activities should bear to each other. For centuries past many questions relating to thought and memory have been discussed with great warmth and earnestness. Which of these two faculties is the more important for culture? Should the memory be cultivated more at one period of life, and the development of the thinking powers be left for another period? Is the great importance given to memory a hindrance to productive thinking? Or, *vice versa*, does the too early cultivation of the thinking powers weaken the memory? There is no

topic of instruction, and no problem of moral education into which these considerations do not enter at all periods of the child's development.

Although our theme embraces, to be sure, two subjects, yet the point of view for their consideration is merely the *relation* in which they stand to each other. Accordingly, there is no need of presenting either all that is known about thought, nor all that is known about memory, but of each subject only so much as is requisite in order to explain the relation between these two mental activities — first of all psychologically, and then applied to practice in the school. In the second place, it must not be lost sight of that it is mainly the practical field of application that gives the subject its broad extent. Let us take an analogous example in physics. The laws of gravitation govern the material world of the whole universe. Nevertheless, the conception of the force of gravitation, together with the most important general laws relating thereto, can without difficulty be made intelligible by the help of well-chosen illustrative examples, together with something of the practical application of these general laws. It would be quite another thing, however, to trace out their application in all directions and ramifications, — in the field of astronomy, geology, meteorology, etc.; further, of architecture, mechanics, navigation, and the many other applied arts. What is possible in physics will probably also be possible in psychology.

Let us note once more our problem distinctly. In the psychological portion of our work we have to consider the thinking process as well as the memory, in so far as is necessary to explain their mutual relation; the practical application needs to be followed only as far as is requisite on the one hand to make the above results still somewhat

clearer, and on the other hand to help the reader to think for himself.

The mental processes or activities are, as is well known, divided into three main classes,—activities of cognition (intelligence), emotion (feelings), and volition (desires and will).

The consideration of our theme will have to do, for the most part, with the activities of cognition; first, because thought and memory of themselves belong to this class, although they stand in very close relation to both of the others; secondly, because the feelings and desires, being more vague and indefinite in their very nature, present much greater difficulties to closer observation and introspection.

Knowledge begins with perceptions through the five senses,—sight, hearing, smell, taste, and feeling (touch, muscular sense, etc.).¹ This is, however, not to be understood as if the sense impressions forthwith produced actual perceptions. They result first of all only in sensations. A perception does not form until a sensation has been frequently repeated, and only after certain other psychic processes have taken place.

The reader should notice from this that the formation of

¹ Whoever wants to, can, even here at the outset, plunge headlong into philosophical and theological speculations, with all their old and all their new controversies. Sensualism here, idealism there, and so forth. Let the reader remember, therefore, once for all, that we are going to concern ourselves with *facts of experience in psychology*—not in how far metaphysical doctrines can be spun from them, but simply in so far as they are able to give clearness and support in our pedagogical practice. In this sense we may accept the old dictum: *Nihil est in intellectu, quod antea non fuerit in sensu*, understanding it to mean, There is nothing in the intellect that does not *presuppose* sense-perceptions.

clear perceptions is far from being so simple as it at first view seems and is generally considered. If a teacher is not thoroughly familiar with the subject of the origin of perceptions, he may assume as certain that in instruction he will make many mistakes, even in the very first stages of the lesson, in particular by expecting more of the pupil's power of perception than he is capable of. A step farther. If such a knowledge of psychology is required in order to give even an object-lesson properly, where things can be presented immediately to the senses, how much more necessary is it when the object must be represented in language, in which case the imagination must assist.

Besides the senses, the mind has still another source of knowledge. The senses make report only of the phenomena of the outer world; i.e., of the things, properties, processes (and their relations) in the world of matter. They say nothing, on the other hand, of the phenomena *in the mind*. These latter processes, belonging to the world of spirit, make themselves known immediately through consciousness. Thus the mind gains ideas not only of the things and processes outside, but also of the phenomena of its own inner life, especially of ideation itself, of feeling, exercise of will, and the relations existing between these. How else would the science of psychology be possible? And all the other sciences of mind — logic, ethics, law, theology, pedagogy, psychiatry, æsthetics, philology, etc. — draw essentially from this second source.

There is a special reason why pedagogy should turn its attention to this second source of knowledge. Those subjects of the curriculum that have most directly to do with character-forming, as literature on its humanistic side and history, belong in so far to the field of psychology.

This is shown by the vast array of names and expressions there met with, that refer to mental qualities, states, and processes. The usual method of presentation aims to bring these concretely before the pupils' minds by the historic events, and by associating these latter with events in the experience of the pupils. But the teacher must be concerned to see to it that meanwhile this second source of knowledge in the pupil's mind is actually at work; i.e., that the words call up corresponding processes and states in the mind. The teacher can do considerable to help in this in two ways, the first of which is applicable throughout the whole course, from the lower grades up; the second is only possible in the upper grades.

The former work will be accomplished if the teacher directs the pupils' attention to psychic processes and states as they occur in the lesson, and does his best to make them definite and distinct. Three objects will be gained by this: first, this kind of instruction will be in the highest degree in the interest of character-building; secondly, the pupil learns to be observant of his inner life; and thirdly, he is collecting in this way a desirable store of psychological material and expressions for use later.

The second part of the work consists of a number of separate lessons in psychology, using the material collected as above. In these lessons nothing more is needed than an arrangement and review of this material by topics; e.g., expressions of knowing (to deliberate, to consider, to find out; silly, wise, ingenious; judgment, question, statement, etc.); expressions of feeling (to mourn; sad, desperate; joy, sorrow, etc.), and expressions of willing (to resolve; stubborn; purpose, etc.). Rightly managed, this may

with profit be begun with children of ten or eleven years.

The perceptions of sense from without, together with those of consciousness from within the mind, form the fundamental stock in trade of the intellect. Out of this raw material the soul creates new forms of knowledge, — concepts and imaginary ideas, judgments and conclusions. We may compare the intellectual activities of the soul to the commercial and industrial activities of the people. We distinguish here, (1) original production, which by agriculture, mining, etc., furnishes raw material; and on the other hand, (2) manufactures, which make the raw goods into something better; and lastly, (3) commerce and transportation, which effect the exchange of goods of both kinds between different regions. In this comparison we would call the sense perceptions (together with the inner perceptions) the intellectual raw production, and the other activities beyond these, mental manufacture and commerce. Now we are going to include all of these higher activities of knowledge, with the exception of imagination,¹ under the name of "thinking." Ordinary usage gives to the word a wider sense; e.g., in the expressions, Who would have thought it (expected or imagined it)? Think of yourself in my place! What do you think of my new hat?

The word "concept" is also used in several different senses. In the following pages it is always to be understood as equivalent to "general notion." Conception is employed as the name of the process by which concepts are formed.

¹ In a wider sense, imagination is included in thinking, since it, too, creates new ideas; but these are never abstract, if the imagination alone is concerned.

"In all thought the greatest beauty is the greatest clearness." These are very nearly the words with which Rector Dörpfeld began a conversation with me in the summer of 1890, when I visited him to consult about the subject of this work. Every one will do well to bear this advice ever in mind, and never be satisfied with a thought until it is followed out to its logical conclusions, and is as clear as it is possible to make it. Confusion of ideas is fatal to all sound work. In an article by Fullerton, *On Sameness and Identity*, in the Publications of the University of Pennsylvania, No. 1, there are enumerated and illustrated no less than *seven* different meanings of the word "same," which, one would think, should certainly keep the "same" meaning better than any other word in the language. Yet, as the author points out, this very term has led to a host of misunderstandings and false reasonings in systems of philosophy. Most of the prolonged and fruitless discussions in which we engage are based on a difference of use in our words, and the consequent misunderstandings they occasion. This is especially true of the mental sciences.

The use of the word "concept" adopted in this book agrees with that of the great majority of writers on psychology, both in this country and in England. Indeed, I know of but two conspicuous exceptions. These are De Garmo, in his translation of Lindner's *Psychology*; and secondly, perhaps following this use of concept as equivalent to idea in its generic sense, M. K. Smith in her translation of Herbart's *Psychology*. I call attention to this difference in use, to prevent confusion.

CHAPTER II.

THE PROCESSES OF THOUGHT AND MEMORY.

A. OF THOUGHT.

As already explained, we understand by "thinking" (in the narrower sense) all of those intellectual activities which, out of the raw material of the senses and inner perceptions, produce new material; viz., higher (abstract) ideas. These activities are usually divided into: comparing, distinguishing, forming concepts, judging, reasoning, etc. This division is not wrong; but if we examine these processes closely, we shall find that they all agree in having essentially to do with ideas, and differ only in the manner of presentation.

Let us examine these processes singly. For simplification we will take the comparison of two objects, say two plants, that are not present to the senses. In order to compare them, they must be so well known that their mental images can be distinctly recalled to consciousness. Thereupon those properties are sought out in which they both agree. When these are found and noted, — i.e., presented to the mind singly, — the process of comparison has in so far reached its end. It is, so far as we are now concerned, the same as if the objects themselves were present to the senses. In the latter case the qualities of the objects would be presented in the mind more vividly; but otherwise the process is the same.

We will take next the forming of conceptions; and first

the so-called class-concepts (species, kind, family, order, class, etc.). The word "mountain," for instance, is associated in the child's mind at first with the perception of a single elevation, which he has seen and which he was told was a mountain. Later he becomes acquainted with several more such elevations, — small and large, wooded and bare, steep and gently sloping, rocky and sandy, etc.; all are called mountain. Now, since those qualities wherein these elevations differed came into consciousness only in a few cases, perhaps only once, while those common to all occurred in every perception, and therefore by this frequent repetition became clearer and more firmly impressed, therefore as a result we find very naturally that those qualities occurring seldom have withdrawn, as too weak, from consciousness, while those common to all have come forward in consciousness, and become distinct. Finally, these latter alone remain, and are the content of the concept. But a concept may be formed on the basis of even a single observation, whenever any one or more qualities in a new object stand out with such prominence as to fasten the attention on them, and thus separate them from the other qualities. The first time a child sees a giraffe, he undoubtedly forms a concept that serves him even if he never sees another. But such concepts are almost sure to be faulty. The mental process is purely spontaneous and involuntary. Language, although not the cause of the process, has favored it very much. In the instance cited above, the fact that two or more different things bore the same name (mountain) aroused the attention, and so led to a clearer apprehension. Secondly, the result of involuntary comparison was step by step fixed in language, and so gotten ready for use. Of course the child has not been

conscious of any of these psychic processes, not even noticing that the meaning of the word "mountain" has been gradually changing, losing one after another the specific qualities, and strengthening into clear consciousness those common to all. Nor has he noticed that the word has narrowed its meaning (content), while it has broadened its application (extent).

Above is shown the involuntary, spontaneous rise of general notions or concepts. To be sure, this mode of procedure alone will never bring the concept to full completeness. For even if really so many examples presented themselves for observation that all the differing qualities could be eliminated, and only the similar ones retained, — which would be expecting a good deal, — still these latter are seldom all distinctly *noticed*. It is very seldom indeed that we can enumerate them separately. But besides this a second deficiency is possible. Among those qualities rightly recognized as common to all, may be found some insignificant ones; i.e., such as do not change the nature of the concept, whether they are included or excluded. A logically complete concept must, however, omit such insignificant characteristics, and retain only such as are essential. In order, therefore, to bring to a conclusion this process of conception, and give rise to entirely clear and correct concepts, something additional is necessary. This is a conscious and voluntary investigation, so as to get rid, on the one hand, of all the accidental characteristics; and, on the other hand, to bring into clear consciousness all those that remain and are essential to the concept. Thus in concepts of classes, or in particular concepts of individual characters, for example, if it is asked what belongs to the essential characteristics of

some historical personage (Socrates, Napoleon, etc.), or of English nationality, this conscious and voluntary part of the work assumes a greater prominence.

From the above, it seems clear that only in the field of science can we expect to find proper, logically complete concepts. The chief intellectual intercourse, even among people of culture, has to rely on the spontaneously formed general notions, which are never perfectly definite, and frequently contain something wrong. This accounts for many misunderstandings and vain disputations. It is further plain that all words, except proper names, denote not properly perceptions, — unless it be when the child hears the word for the first time, — but general notions (concepts).

Next to the formation of concepts, comes the apprehension of the relations between things or processes, of which the causal and mathematical relations are the most important. Here, too, we make use of the word “conceive”; and we shall find thinking in this case also is only a particular way of presenting ideas in consciousness. We will take an example of the causal relation. What is the origin of our conception that cold is the cause of water changing into ice? In the beginning it is quite spontaneous. It is noticed that with a greater degree of cold, ice appears; and again, that when the cold disappears the ice vanishes. This is, however, still by no means sufficient to give rise to the conception of a causal connection. For there are no innate ideas waiting, as it were, for outer stimulus in order to make their way into consciousness. The sequence of those two phenomena (cold and ice) is observed not only once, but again and again. This regular and invariable sequence of these phenomena produces the new idea finally that the one thing *must* follow the other,

that the one phenomenon calls forth the other, causes it. Hereupon the relation between the two facts, which before seemed only temporal, becomes apprehended as causal in its origin; out of *post* (after) has become *propter* (on account of, by means of). The further details of this causal relation can, of course, be learned only by an investigation into the physical nature of cold and of water. That the conception of mathematical relations, as they occur in arithmetic, for instance, in the fundamental operations, in proportion, etc., rests likewise on simple elementary perceptions, is shown sufficiently in the schoolroom.

We come now to the formation of judgments. In the simple proposition, "Snow is white," two ideas are in consciousness, — subject and predicate. We have here a so-called analytical judgment, since the subject-concept "snow" properly includes in it the characteristic "white"; the latter, in order to direct attention to it, is separated in thought from that complex. It is the same with the proposition, "Mint is a labiate." The latter concept contains characteristics which are already in the subject-concept so far as this is completely apprehended; but for the time being it is singled out for emphasis, that it may be once for all distinctly noticed.

Let us take now an incompleting judgment, such as occurs in the question form; e.g., How much is 3×4 ? Here the predicate idea that belongs with the subject is still to be sought. The ability of the pupil to answer depends on whether the percepts of the numbers, of which the predicate is composed, are so clear and so mobile in his mind, that the idea sought, which he has already learned from adding, can now arise in consciousness. If this takes place, subject and predicate stand side by side in con-

sciousness: the judgment is complete. That which would cause the pupil trouble is moreover something that comes properly before the act of judging; for the latter is nothing else than an act of mental representation, wherein two concepts (in the sense of subject and predicate) stand together complete in consciousness. Of course the judgment may be more complex than in the above examples, — if either the subject or the predicate, or both, have a more complicated form. For example:—

“In the Acadian land, on the shores of the Basin of Minas,
Distant, secluded, still, the little village of Grand-Pré
Lay in the fruitful valley.”

Here are associated with the subject (the village of Grand-Pré) certain characteristics (distant, secluded, still, little); and likewise the predicate (lay) is further, in local and other respects, more exactly described (in the Acadian land, on the shores of the Basin, in the fruitful valley). In this way arises one complex of ideas there grouped about the subject, and another one here forming the predicate. This does not, however, in any way change the fact that in both cases we have to do merely with the *presentation of ideas* in consciousness. Although the two groups of ideas are at first held asunder as subject and predicate, in order that they may be more sharply examined and plainly apprehended, yet they combine again in consciousness to a compact mass of ideas which must be apprehended as a whole. The peculiarity of judgments, therefore, lies in this: that the two ideas or complexes of ideas separating at first as subject and predicate thus become more sharp and distinct, and therefore combine afterwards all the more readily. Judgments are, accordingly, a *chief means of making ideas plainer, and of im-*

pressing them more firmly on the mind. The reader will now see at once the importance of the art of questioning, as well as its special purpose.

It should be remarked further, that when we speak of a "thought" we generally mean a judgment; but the expression may, in the wider sense, also stand for a single idea.

We have yet to analyze the process of *reasoning*. Take the simplest possible example: —

Major premise: New England belongs to the United States.

Minor premise: Massachusetts belongs to New England.

Conclusion: Therefore Massachusetts belongs likewise to the United States.

As is readily seen, to reason is to judge. What is the difference, then, between the syllogism and other judgments?

Logic says: reasoning means deriving a new judgment from two or more given ones. Let us look at the matter more exactly from the psychological side, and ask what takes place in our minds when we reason.

Whereas in the simple judgment only two concepts, subject and predicate, are held in consciousness, and represented in their relation to each other, in reasoning three concepts are present, and therefore also three relations. In the above example the three concepts are: New England, Massachusetts, and the United States. It is this complexity that makes reasoning more difficult than the other processes of thinking; or, in other words, the effort to hold in consciousness at the same time so many ideas, together with their relations, in perfect clearness.

In the above example the question is, What political

relation exists between Massachusetts and the United States? This is supposed to be unknown, or at least not yet fully determined. As a help to the mind, we insert between the two concepts, "Massachusetts" and "United States," which are for consciousness too wide apart, an intermediary concept, "New England," whose relation to Massachusetts on the one side, and to the United States on the other, is already known.

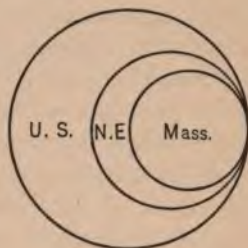
The reader will have no trouble in recognizing that this help to thinking — the insertion of a middle concept between concepts lying too far apart — is entirely similar to the help that one makes use of when one is crossing a creek or ditch that is too wide to jump over. If one succeeds in throwing a stone into the middle of the creek to step on, thus requiring instead of a big jump only two little ones, the trouble is avoided, the impossible is made possible. *Here we have the secret of reasoning*, as will be shown more exactly later. The above comparison may further serve to call attention to another fact. It is customary to begin a syllogism with the so-called major premise; but, as in crossing a creek as above, the second step cannot be taken before the first, so one ought in reasoning to begin, not with a major premise, but with a minor premise; for the movement of thought proceeds most easily from the minor premise to the major premise, as is shown by the very name and purpose of the middle term.

Let us call to mind now the mental state after the insertion of the middle term, — what is known and what is still sought. Known are two relations: that of the first term (Massachusetts) to the middle term (New England), and that of the middle term to the third (United

States); the relation of the first to the third is sought. This latter relation must be contained impliedly in the two known ones; for else it could not be inferred from them. But since it had not previously been recognized, the light necessary to see it must have been wanting; and if it is to be really noticed now, this illumination must come to it from some source. But whence can this light come, since the process is a purely internal one, and therefore cannot receive help from the senses? Evidently from the already known ideas, the premises. The successful result depends first of all on their clearness, and secondly on whether they are retained in consciousness until their light has spread over the third relation. If this does not take place at the first attempt, it must be owing to the fact that the full illumination is wanting; i.e., that the preliminary conditions—clearness and repose of the ideas in the premises—are not yet fulfilled. In such case those two ideas must be repeated and kept in consciousness until, on the one hand, all indistinctness has disappeared from them, and, on the other hand, no more disturbance is caused by other ideas.

We see from the above that even reasoning, which at first appears so mysterious, is nothing more than a kind of mental presentation of ideas, which is distinguished from other mental presentations only in that it depends on the clearness of two other groups of ideas, and on these remaining clear in consciousness. That this is so, and indeed that reasoning differs from the sense perception of such relations only in that the former is a purely internal process, while in the latter case the objects are present to the senses—of this one can immediately convince one's self by representing symbolically to the senses the three

terms of a syllogism, together with their relations. This symbolical representation is usually made by three circles whose size and position represent the three terms with their relations. In this way, as the text-books of logic show, all the figures of the syllogism may be represented graphically. The circle may stand as the symbol both of the content as well as of the extent of the concepts. The meaning of the figures will be most easily understood, however, if the circles stand only for the extent of the concepts. The example given above belongs to the first and simplest figure of the syllogism, and is represented graphically, as in the margin.



The three terms are here represented in their extent by the visual image of the circles. The three relations of size, together with that of inclusion or exclusion, can be apprehended completely, as if they were so many sense perceptions. There is, accordingly, here no possibility of any difficulty in apprehending the third relation. This is, furthermore, the reason why the first example was chosen from geography, since the relation of size in the three terms is here of itself concrete. If the teacher wants to make trial of the above drawing with his pupils, he may try it first with different words, so as to direct the attention to the size only. For example, the first circle (Mass.) is smaller than the second (N. E.); the second is smaller than the third (U. S.); therefore, etc. If he wishes to make the process still plainer and more concrete, he may place three pupils of different height in a row before the class. A is shorter

than B, and B is shorter than C. If now he asks whether A is also shorter than C, every one will be ready with the answer, "Yes; certainly." From the above the reader will be convinced that *reasoning when it takes place internally, and without outward help, is still precisely the same process as when the three objects are present to the senses.* Further: that the success of the unaided internal reasoning depends entirely on whether the two premises can be clearly presented and retained for a time undisturbed in consciousness. The same is true of all the other forms of the syllogism. Why these latter are usually more difficult does not concern us here.

We have now examined in their main features the most important processes (comparison, conception, judgment, and reasoning) of the human understanding, and have found that each consists of a mental presentation of ideas in consciousness, or of a combination of new ideas.

Before we take up the memory, I want to make a remark about sense perceptions. Although this may not seem to belong to our theme, still it will later be seen that the above discussion, particularly one point in regard to the formation of concepts, is thereby desirably supplemented. The mental picture of a complex object—e.g., of a mountain, plant, etc.—is usually thought of as a mental product that has come all at once into existence in this complexity, just as a photograph is made by one flash of the camera. Of course it looks as if we adults could certainly obtain a mental picture of such an object by a momentary glance of the eye. This, however, is an illusion, but more especially in the case of a child who is just beginning to use his senses. For perception even the simplest object is in

reality compound. It consists of form, size, color, material, weight, hardness, etc.; and the form is, in addition, composed of elements even in the case of the simplest body, namely, a sphere. In a simple tone we may distinguish four elements, — pitch, color, intensity, and duration. Now, the only way in which any one can secure a distinct perception of any complex object is by quickly or slowly, or even at different times, examining and noticing every characteristic separately. Furthermore, be it remembered, every characteristic must be repeatedly observed before the first (obscure) impression can grow into a (clear) perception. Such a perception is, accordingly, to be thought of not as a picture made with a flash light, as it were, but as a mental product consisting of a number of simple or single ideas; viz., as many as there were characteristics noted. In short, it is a complex of ideas. In this sense the saying, "Our knowledge is piece-work," may be applied here. This complex appears to consciousness, of course, as a whole or unit, because the object is a unit.

As a rule, concepts also, as we have seen above, are complexes of ideas, but of an entirely different kind. In sense perception the characteristics combine in the idea because they are united in the object; on the other hand, in conception we have only definitely selected characteristics; namely, such as have been chosen by comparison of several ideas, thus separating, first of all, common characteristics, and afterward from these, by a more exact examination, the essential ones. This knowledge that both sense percepts as well as concepts are complexes of ideas, should direct our attention to several other important questions.

1. Why is a concrete percept fresher, more vivid, and more effective than the corresponding concept, although

the latter is less compound than the former? It seems now very generally admitted that thought is always accompanied by motor manifestations. These are, of course, more pronounced in the case of sense perceptions, and decrease in intensity more and more as the ideas become more abstract. In abstract ideas of the scientific sort, this motor element is reduced, it would seem, to the mere word, so far as it appears in the innervation of the muscles of speech. This being the case, it would seem clear that the freshness and power of concrete ideas depends, for the most part, on this re-enforcement received from the motor element. Some go so far as to say that all volition, even the calling up of the visual or auditory images in the mind, is effected by the innervation of muscles, and that the only possible expression of will power is through muscles. So far as this is true it throws important light on the subject of physical culture, and gives a new reason for muscle training.¹

2. Since the single ideas which go to make a concept are also contained in the different complexes of ideas out of which they were chosen, as well as in the other complexes of ideas that belong under this concept, and since, further, each of these single ideas united with others occurs in still very many other complexes which do not belong to this concept, how is one to think of the existence in the mind

¹ Ribot, along with many others, accepts as "a fundamental law that the reflex is the sole type of all neural action, of all relation," and hence that "every state of consciousness always has a tendency to express itself, to manifest itself, by a movement, an act." See Ribot's *Diseases of the Will*, *Psychology of Attention*, and *Diseases of the Memory*, three little books of 120-200 pages each, full of very suggestive ideas for every teacher. Münsterberg has based his theory of association of ideas on the motor element in all thought.

of the single ideas, of the complexes of ideas, and of the concepts? In other words, and more exactly, does such a single idea (e.g., round, four-cornered, long, short, broad, narrow, bitter, sweet, learned, smart, foolish, just, etc.) exist many hundred times in the mind,—once perhaps as a single idea, then so and so many hundred times in different lower and higher concepts; then, again, so and so many thousand times in sense perceptions,—or must one think of it in an entirely different way? And how do the concepts and sense perceptions themselves exist in the mind? This is not the place to attempt a final solution of these questions by argument; but a comparison with another field of phenomena that lies open to every one's observation can perhaps put us on the track of a correct understanding. This field of phenomena is human society. There are here, first of all, individuals; further, families, groups of friends and relations, civil and religious communities, cities, towns, states, nations, federal unions, guilds, railroad companies, singing-societies, missionary societies, and all the other many small and large associations for different purposes. All of these exist; but *how* do they exist? Is the existence of an individual of the same sort as that of a society? Does each human being exist first as an individual, and then once more as a member of a family, and once more, again, as a member of society, and further, as many times as there are different associations to which he belongs? To be sure, we say the family, the community, the state, etc., exist, and of course they do exist; but what is it in each of these cases that exists *bodily*? Evidently that which exists as an actual being is only the individual. The names, family, circle of friends, singing-societies, etc., denote not actual beings, but only relations of bodily beings

or individuals to one another. They are concepts of relation. That which exists in human societies is nothing more than these relations, and they exist only as qualities of individuals. Thus, for instance, friendship has its existence in the mutual affection of those concerned,—the nation, in the language which its members speak,—the social organizations in the consciousness of common interests, and perhaps also in sympathetic feelings, etc. These relations are also sometimes very well expressed in outward forms to the senses: thus nationality in the audible and visible forms of language, the other associations by written statutes, by symbols of recognition, etc.; but all of these are only *signs* of the relations or real qualities of individuals. Moreover, the associations can also carry on all sorts of work, great and small, — present operas on the stage, build railroads, fight battles, spread culture, etc.; but the real power that accomplishes this work is not in the “singing-society,” “railroad company,” “state,” “school,” etc., but in the separate children of men which have applied their hands to the undertaking. There is, of course, no “spirit of the times,” “class spirit,” etc., in actual existence outside of rhetoric and poetry.

What you the Spirit of the Ages call,
Is nothing but the spirit of you all.

Faust, part i. scene i.

If accordingly one wants to know what really exists in the concepts, community, state, etc., one must turn to the separate human beings. Thus, a person may be by profession engaged as a teacher; the same person, however, is perhaps, at the same time, husband, father, son, brother, etc.; in another relation the same person helps represent a religious and a civil community; furthermore, a state,

a schoolmasters' association, a charity organization, etc. Notwithstanding all of these divisions of a person's life, the person does not become divided, but remains as he is, — an individual, *indivisible*; and just as little is he multiplied in number, remaining what he is, — a single person.

It is precisely the same with the intellectual products of the mind, the separate ideas and their different combinations, — percepts, concepts, imaginary ideas, trains of thought, complexes, and systems of ideas. Corresponding to the individuals in society are here the simple ideas; i.e., the partial ideas or characteristics. Such an elementary idea helps at one moment, united with others, to form a sense preception; at another moment, a concept or an imaginary idea; and so from moment to moment still other complexes of ideas. Nevertheless, it exists in the mind only once, — just as a person exists only as a single being. All complexes of ideas, on the other hand, exist in the mind not as separate things outside of and in addition to the simple ideas — or else each of the latter would have to be present as many times as it has entered into combinations. Notwithstanding this, since these complexes appear in consciousness as complete wholes, they seem to be separate things. All that is to be regarded as essentially existing in these phenomena — aside from the constituent elements or simple ideas — are solely the laws of association by means of which these separate ideas are called into consciousness at the same time. This point, — namely, that only the simple ideas are the proper mental existences; that, on the contrary, all complexes of ideas are only transient combinations, — must be distinctly understood and kept firmly in mind, if one is ever to escape from the fog and din of psychological discussion. But this also opens

up a view into the wonderland of the soul, so that one does not know which to admire the more, — the illimitable diversity of phenomena, or the extraordinary simplicity of the controlling laws.

If the reader is at all inclined to follow out the relation of logic to psychology, and particularly of the different figures of the syllogism in sense-perception and abstraction, he will find a very profitable discussion from the Hegelian standpoint in Harris's *Introduction to the Study of Philosophy*, Section V., where Dr. Harris "develops some new insight into the nature of sense-perception," which he "has recently discovered after many years' study on the subject" (p. 96).

On the processes of thought, see Dewey's *Psychology*, chap. viii., "Thinking"; a clear and concise account. Sully, in chap. ix. and x. of the *Outlines of Psychology*, is particularly good, since his description is from the *psychological* standpoint, instead of from the point of view of *logic*, as is the case with nearly all the other text-books. Preyer's *Mental Development of the Child* contains, p. 80-83, a sympathetic account of the development of a child's thinking powers. The formation of higher ideas is described in chap. viii.; the influence of language on the development of thought, p. 159-163, and still more fully in *Development of the Intellect*, chap. xvi. p. 3-33.

The teacher will find many clear ideas and interesting points brought out in James's *Psychology*, I., chap. xii. and xiii. on conception, discrimination, and comparison. Read also chap. ix. on "The Stream of Thought."

Baldwin (*Mental Development in the Child and the Race*, 1895) lays great stress on the motor side of thought, going so far as to define conception as a "motor habit" of reaction. Hence he denies all content to abstract terms, and claims that they are simply "attitudes, expectations, motor tendencies." Royce seems to agree with all of this.

B. OF MEMORY.

The expression "to commit to memory" is usually employed in a narrow sense, being restricted to a particular manner of committing; viz., by repetition. It is sometimes

used in a still narrower sense to refer only to ideas clothed in words. While this is all right so far as the meaning of the word is concerned, if sanctioned by usage, we should, however, bear in mind that the word "memory" has also a much larger meaning, and that there are other ways of committing to memory besides repetition. It is nowhere more harmful than in the field of psychology to take the traditional and popular meaning of an expression as a scientific guide, without due consideration. For the popular meaning dates usually from a time when psychology "had not where to lay its head," to say nothing of scientific recognition. The meaning referred to above assigns to memory but half its field, and restricts its action in that field. This is not true of the following definition taken from the *Century Dictionary*: "Memory is the mental capacity of retaining unconscious traces of conscious impressions or states, and of recalling these traces to consciousness with the attendant perception that they (or their objects) have a certain relation to the past." The word is also used for the power of such retention alone; while the power or act of recalling is termed recollection. While it is in the larger sense above that we use the word here, we must notice these two aspects of memory. The first has reference to its content, the stock of ideas present, together with the associated feelings and desires; the second looks to the power of the mind to recall these to consciousness. Since, however, the second presupposes the content of memory, the following discussion will be confined to the power of recollection. But the reader will please bear in mind that the content of the memory includes, not merely this or that special kind of mental product, but all kinds whatsoever, every mental state, whole or partial, that has ever occupied consciousness.

With this understanding we could then at once proceed to consider the laws of memory according to which ideas are recalled to consciousness. But such general statements as were before made in regard to the content of memory and the power of recollection are altogether too liable to present to the reader many obscure points, unless they have come after the consideration of a large number of observed facts. We shall, therefore, first present examples of some of the different kinds of recollection.

First of all, take those instances of which we commonly think when we speak of memory, — the reproduction of groups and trains of thought which have been intentionally committed to memory by repetition; e.g., words of a foreign language, a melody, a map, a literary selection, etc.

With these the reader may compare those recollections which, while likewise very prominent, are not the result of any intentional committing to memory. Thus we can, for example, call to mind, as plainly as if present to the eyes, the appearance of our father's house outside and inside, with all its rooms and furniture; likewise our parents, other relatives and neighbors, and the whole landscape of the home of our childhood, with all its roads and paths, mountains, valleys, woods, fields, and groups of houses. Similarly we can recall with ease the mental picture of other houses and places in which we have lived for any considerable time. The mother tongue is also learned in this way, so far as it takes place without regular instruction. In all of these and similar cases there has been a frequent repetition of the perceptions, which fact is the cause of the distinctness, fidelity, and certainty of their reproduction; but the repetition has not been intentional.

The exact reverse of these examples would be such re-

production as takes place after only once receiving the impression. In such cases there is neither intentional nor unintentional repetition to help the memory. Thus, for example, if the teacher after relating a story, thereupon asks questions in regard to its main features, or calls for its repetition at once; or if he calls on his pupils to repeat after him a sentence or a verse; or if a child after he has once been taken to a distant place, then has to find his way thither alone.

In all of the above examples the act of reproduction is prominent. But there are also mental processes in which the memory plays a part without our usually thinking of it. These cases are for our investigation quite as important as those above, and must also be illustrated by some examples.

What is meant when we say that the pupils have satisfactorily *understood* what was told them in the history lesson? What is it that has taken place in their minds? Let us see. First of all, the pupils have heard the spoken words; or, more exactly, they have had auditory sense perceptions. In the second place, with each word and sentence as heard the sense has occurred to their minds; i.e., the mental pictures of the things denoted by these words (persons, objects, processes, and relations) have had to appear in consciousness. Now, all this presupposes, of course, that the meaning of the expressions used was already known. In order to understand what was related to them, the pupils have therefore had to recall continually to mind already known ideas. At the sound of the words these ideas arose from the depths of the mind into consciousness, and so grouped and arranged themselves that the story seemed to take place, as it were, before the very eyes of

the pupils. This process of understanding depends accordingly on the working together of two entirely different mental processes :—

- (1.) On a new perception (through the ear); and
- (2.) On a resulting reproduction of old ideas.

When we say that such an understanding requires imagination, we mean, first of all, to say that the persons, objects, and events, which the pupils are to think of, do not stand before their eyes bodily, and therefore cannot be perceived by the senses. The expression merely emphasizes the second factor of the process, — recollection.¹

All that is said above in regard to understanding what is orally related is of course true of oral instruction of every kind, as well as of conversation and of reading, except that in the latter case sight takes the place of hearing. In short, the immediate understanding of language of any kind depends on the two factors named, — the sense perception of the verbal forms, and the resulting reproduction of the associated ideas.

We will now examine the process of the formation of *concepts*, to see what part memory plays here. We saw above how the child in an entirely natural and spontaneous way proceeds gradually from the percept "mountain," to the concept "mountain." When he sees another elevation, and says, "That is a mountain *too*," this shows that the former image must have occurred to him again. Even the very name used is recalled; and this fact bears witness that its meaning also, the idea, has returned more or less distinctly. When a third, fourth, or fifth mountain is seen,

¹ No allusion is here made to that free scope which the imagination has, or might have, in such a case as the above, in picturing the details that are not described in words.

this reproduction is repeated; for if it were not, the formation of the concept could not proceed. All of this shows plainly that even in the spontaneous rise of concepts, memory is an essential factor. From step to step the new perception forms the first factor, and the reproduction of the corresponding earlier idea, the other factor. And it is the latter that is essential to the process; while, on the other hand, the sense perception, as we shall see later, may in other cases be replaced by a reproduced idea.

But the spontaneous formation of concepts must be supplemented by instruction. With this purpose in view the teacher may have his pupils observe and compare two or more objects present to their senses, or pictures of such objects. If, however, the objects in question are already known to the pupils, the comparison might take place as a purely internal process, relying on *reproduction alone*. If they are incorporeal in their nature, as is mostly the case in the field of mental sciences (e.g., if peculiarities of character, moral and religious causes, social relations, etc., are to be considered), the comparison cannot be otherwise than purely internal; i.e., based on reproduced ideas. The only reason why school instruction seeks to present material objects *to the senses* when they are being studied, is, on the one hand, to make the comparison easier; and, on the other hand, to be able to correct any mistakes promptly, — in a word, in order more certainly to secure a good result. Accordingly, it is not essential to the process of conception, that the objects be presented to the senses; this process merely presupposes that there are concrete ideas present in the mind. They form the raw material, out of which something new is to be created; and it makes no difference whether these were gained earlier, or were just received, or were again refreshed by perception.

It is very similar with the formation of *judgments*. In this process, as we saw before, two ideas — subject and predicate — come into consciousness together, as if they belonged together in this particular relation. It was further to be noticed that this separation into *two* of what was still to be thought of as *one*, has the purpose and result of laying greater stress on one of these ideas; namely, the predicate. The judgment, "The boy is writing," means essentially nothing more than the expression, "a boy writing." There is, however, this important difference between the two mental acts, that in the latter case the characteristic "writing" is of the same dignity as the rest, while in the first case it receives all the emphasis of a chief characteristic. One step farther. If this selection of a single feature out of a complex idea, as it is outwardly represented in a judgment expressed in language, is actually an act of the mind, which would take place according to natural laws even without the mediation of language, then the formation of judgments must be just as spontaneous as that of concepts. But if this is so, how does the mind come of itself to adopt this judgment form? In other words, what is the natural and spontaneous process of making a judgment? As preliminary to the answer, we may say at once, that if, instead of an ordinary complex idea (for example, a boy writing), there arises in the mind a judgment idea (the boy writes), or, in other words, if out of a complex idea a single characteristic rises in consciousness superior to the rest, there must have been some impulse present to cause it. We must try to find this impulse. If we discover it, all that was obscure in the making of judgments will probably become clear.

There is one incentive to the making of judgments which,

though artificial in its nature, school practice has known from time immemorial; and wherever it has been rightly understood, it has been diligently employed. It is the *interrogative form*. A question is, as already remarked above, an incompleting, half-finished judgment; one portion of a complex idea, whether subject or predicate, is named, while the other part is to be sought. Both subject and predicate may be named, of course, in the question, but in such a manner as to require some further qualification of the one or the other. The interrogative form accordingly makes the pupil notice an omission in an already known complex idea, and points to it with the finger, as it were. That is the *external impulse*. In the attention thereby roused and directed to this omission, lies the *internal impulse*; so that the idea sought is, on being found, brought more strongly and separately into consciousness. This completes, then, the act of judgment; for a judgment is, as we must keep well in mind, not a mysterious miracle, but nothing more than the simple process by which, out of a conscious complex idea, a partial idea arises so strong as to gain separate attention. The interrogative form is therefore an example of how through language a person may intentionally lead another to make use of the judgment form; but we have yet to seek the impulse that calls forth spontaneous judgment. In this case the source must be in the object; i.e., some characteristic of the object itself must strike one prominently. All natural circumstances which arouse the attention, — provided they direct it to something definite, — find their expression spontaneously in the form of judgments. Every good language lesson will make abundant application of this principle. Teachers have every cause to pay special attention to that part of psy-

chology which treats of spontaneous attention. The most prominent of these incentives to attention is contrast, which we will illustrate by a couple of examples.

Suppose a child has, until now, seen only red roses. When he sees a yellow one for the first time, his attention will be roused. The present sense idea recalls the earlier image of such flowers, so that there are now two ideas in consciousness. In so far as they are alike they are taken in as a matter of course, and no notice is taken. The differing characteristic, "yellow," on the other hand, which causes the contrast, attracts attention, and pushes to the front in consciousness. Although the new object is perceived in its totality, still this differing characteristic is prominent, and therefore gains special vividness. It is, properly speaking, a new piece of information. Now, it is just this peculiar state of ideas that we call a judgment. It is plain to see, moreover, why the expression, "a yellow rose," in which the characteristics are co-ordinated, does not satisfy the mind, but only the *pointed judgment*, "This rose is yellow."¹ It makes no difference whether this is spoken or not; for judgment is a purely mental process. Take another example. A team of two black horses is passing by. To an observer the sight would probably produce an idea such as would find expression in the

¹ The Chinese language is not inflected, and, like other languages originally, operates with word roots of only one syllable. The position of the qualifying word before or after the substantive distinguishes the attributive from the judgment form. Thus the sound *ta* means, without any change of form, great, greatness, and to be great. If *ta* stands before a substantive, it has the meaning of an adjective. Thus *ta jin* means a great man. If *ta* stands after a substantive, it is a predicate, or, as we should say, a verb. Thus *jin ta* (or *jin ta ye*) would mean, The man is great. See Max Müller, *Lectures on the Science of Language*, i. p. 301-302.

words, "two black horses." If, however, one of the horses is white, the contrast would attract notice, and lead to the more pointed expression, "One horse is black; the other is white." The reason for the double judgment, as one sees, is the fact that the two rival objects appear simultaneously to the senses, and therefore have equal claim to be regarded or judged.

We now return to our original point of view, and inquire in what measure memory helps in the formation of judgments. This depends in each case on whether the two ideas which lead to the judgment are from immediate observation or are reproduced. The former condition, as in the last example above, will seldom be fulfilled. Instances such as the first example above, in which one idea is a perception, the other a recollection, are much more frequent. In the field of the mental sciences, in which most ideas are conveyed by language, both terms of the judgment must be, for the most part, reproduced ideas. We have been considering the unintentional or entirely spontaneous judgments. When, however, the process is intentional and meditated, we find just the same three cases; only it is to be noticed here, — e.g., in silent meditation, in conversation, or in the composition of any writing, — that the reproduced ideas are still more frequent. Accordingly, an abundant supply of ideas by the memory is requisite for the ready exercise of judgment.

It is hardly worth while to speak separately of the process of reasoning, since it has to do with judgments, and its conclusion is likewise a judgment; and therefore all the above discussion applies equally well to it.

What has now been said of the origin of concepts, judgments, and reasoning, shows that even in these processes

of thinking proper, memory plays a much greater part than is commonly believed. Nor have we called to mind yet all the assistance that memory renders in the process of thinking.

We saw above that the understanding produces new ideas, either conceptual or judgmental in form. Either:—

First, on the basis of two perceptions; or,

Secondly, on the basis of a perception and a reproduced idea; or

Thirdly, on the basis of two reproduced ideas.¹

We have assumed above that sense perception is exclusively an activity of the senses, and that it belongs, therefore, entirely to the elementary raw production of the mind. This is, however, not the fact. Only in contrast to the new ideas which are produced in thought and imagination can the perceptions rightly be called raw products. It is, of course, true that perceptions of the outer world are possible only through the senses; but that is not saying that they are exclusively a product of the senses. The senses by themselves never produce anything but sensations, even in the case of the practised senses of adults. Suppose, for instance, that a certain object has once produced a sensation in the mind; when this takes place later, a second time, this new sensation will recall the former one. This reproduction does not, however, result in a twofold sensation, or double seeing; but, since the two sensations are completely alike in their content, they coalesce in consciousness into one act; in other words, they unite in result, so as to be much *stronger* intensively than the first sensation was. With every following new

¹ For the sake of brevity we speak here of *two* ideas, but of course in every case there may be several.

sensation coming from the same object, this reproduction of previous similar sensations, or of their last total result, is repeated; as well as their coalescence in consciousness. As this composite act becomes intensively stronger and stronger, i.e., plainer, it comes at last to be what we call perception. Thus, although an act of sensation must be oft repeated if it is to give rise to a perception, still the real reason of the superiority of the latter, as one sees, does not lie in this repeated production of the new sensation, but in the resulting production of the already present similar sensations. The fact that we are not conscious of the reproduction in these cases is because the newly produced sensation and that which is reproduced are completely, or at least essentially, alike, and therefore at once run together, or fuse into one act of sensation. Later on, when these combined acts have perfected themselves into an objective perception, we often notice very plainly that a reproduction has taken place; for in these cases we speak of "recognition." If now, as we have seen, even the apparently primitive perception receives its main strength from a reproduction of former sensations, it is plain that those processes of conception and judgment which are prompted by a transient perception (see above, p. 34) also receive this sense element chiefly from recollection, rather than from the senses direct.

For the present, let us lay particular emphasis on this fact, that knowledge is necessary for the assimilation of knowledge. If some would object to the use of the word apperception in such an extended meaning, they will at least have to content themselves with the fact that in all the operations of the mind the memory plays a more or less conspicuous part, and is always essential to the con-

scious processes of thought. Lange and De Garmo do not hesitate to say that "all learning is apperceiving." The reproduced ideas are the "apperceptive organs" for grasping and assimilating the new.

We can close our empirical treatment of the memory here, and sum up the results as follows:—

(a.) MEMORY in the widest sense is the mental capacity of retaining and recalling all the sensations and perceptions, as well as all the products of thought and imagination, whether ideas, feelings, or volitions, which have existed in consciousness, including all the associations formed among these mental states.

(b.) In the memory we must distinguish a *passive* and an *active* side, if these expressions may be allowed for the time being. As apparently resting or passive, we understand the memory in so far as the ideas, etc., are *unconscious*; as active, when these are *recalled*, i.e., brought again into consciousness.

(c.) Whatever of the content of memory cannot be recalled, or, as we say, has been entirely forgotten, is for the mind, so far as we can see, of no consequence; i.e., so long as it cannot be recalled. It is this *power of recollection*, or the active side of memory, that properly forms a subject for study.

(d.) The memory is not a separate so-called "faculty" of the mind, in the sense of a special, independent power. The passive or resting side of memory only implies that there are already ideas in the mind, living and existing; the active side implies nothing more than that these ideas, under certain definite conditions, can be recalled. This power of recall, however, may differ much in the different ideas; it may be greater or less with respect to the fidel-

ity or exactness of recollection, or with respect to promptness, rapidity, or reliability, after a considerable interval. And this depends in each separate case entirely on the compactness or looseness of the idea in question, and on the extent to which it is advantageously associated with others. The power of recollection, or the active memory, is therefore an individual peculiarity of the separate ideas, and not a general power behind them. If one uses the term power at all, it ought to refer to the power of existence of the ideas (above mentioned), meaning thereby that they strive to become conscious; and further referring to the individual quality of the different ideas, the greater or less completeness of their structure, and the greater or smaller number of their associations. There are, therefore, to use a paradoxical expression, AS MANY DIFFERENT KINDS OF MEMORY IN THE MIND AS THERE ARE IDEAS.

The memory is for the whole mental life — we have in mind particularly the intellectual side — *of wide and far-reaching importance*. Even the most primitive ideas (the perceptions) require its indispensable aid; but still more necessary is it in the processes of thought and imagination. Without the help of the memory, not even perceptions would be possible, to say nothing of concepts, judgments, and reasoning. The relation between memory and apperception is that of means to an end; but each is a means to the other. Apperception is the assimilation of new knowledge, whether percept or concept, by means of the ideas called up in memory; but this process is, in turn, itself the very best, if not the only, means of storing up ideas, so that they will not be forgotten.

It need scarcely be said that this last paragraph, as well as the whole preceding section, is not to be understood in

the sense of the traditional memory worshipper, who believes that the main object of the school is to store the memory with facts and words. In the course of our work, the miserable defect in this way of teaching will be brought to light, as well as some mistakes of those who aim at just the opposite.

On the value and art of questioning, consult Fitch, *Art of Questioning*, and chap. vi. of the *Lectures on Teaching*. For the dependence of memory on attention, and the physiological basis of attention, read Ribot, *The Psychology of Attention*. For the most generalized conception of memory, see Hering's famous lecture on *Memory as a general function of organized matter*, in No. 6 and 7 of *The Open Court*, Chicago. See also *Religion of Science Library* (same publishers). There is another translation of this epoch-making address in Butler, *Unconscious Memory*, chap. vi. Ladd's *Physiological Psychology* expresses the same ideas. "Every organ — indeed, every area and every element — of the nervous system has its own memory." (p. 553.)

CHAPTER III.

THE LAWS OF THOUGHT AND MEMORY.

Truly the fabric of mental fleece
Resembles a weaver's masterpiece,
Where a thousand threads one treadle throws,
Where fly the shuttles hither and thither,
Unseen the threads are knit together,
And an infinite combination grows.

GOETHE'S *Faust*: BAYARD TAYLOR.

AFTER reviewing the chief processes of thought and memory in their many forms, it remains to discover the genetic order in this manifold complexity, the active forces in these processes and their laws. What we see in the world of matter, will also manifest itself in the realm of spirit; howsoever wonderfully diversified the phenomena may be, even so wonderfully simple are the laws that control them.

The foregoing investigation led from thought to memory; the following will begin with memory, and therefore spin its thread in the opposite direction.

A. OF MEMORY.

Even Aristotle had already found out that ideas were not reproduced in lawless confusion; i.e., that it was not dependent on mere chance, whether this or that idea arose in consciousness. First of all, he noticed that a previous idea does not, of its own accord, return into the mind but by invitation; at the call, as it were, of another idea which is

already in consciousness. This was of itself an important discovery. It showed what one must look for in order to come on the track of the ways and laws of reproduction; namely, for the relation existing between the two ideas.

To proceed with his investigation, he had, accordingly, first to collect a fund of examples in which one idea recalled another, in order then to try whether the cases could be brought into definite order under the given point of view. His task was, therefore, that of classification; and the objects were, exactly expressed, the different relations that occurred between the two ideas reproducing each other in those examples.

If he had, for instance, a case in view where the thought of the old homestead immediately recalls the idea of the adjoining trees or the neighboring house, etc., — in like manner where the thought of a certain plant brings to mind also the image of the place where one first found it, and the other objects in its vicinity, — he may have noticed how all of these examples agree in that the objects represented by the associated ideas are near together in place. With the discovery of the common characteristic in these cases, some order seemed already to come into the chaos, and the investigator could further assume that the discovery he had made would also shed light on other cases. This hypothesis had now to be tested. Accordingly, a number of other examples were sought of objects near together in place; and, as before, the ideas in question were found to reproduce each other. This seemed, at least, to establish a firm standpoint from which to look out over a tolerably large part of the field. However, there had been found other examples which, though very similar, still did not quite exactly fit into the hypothetical class ("near in

place"). Thus, for instance, that the thought of an absent friend recalls the idea of the place where we have last spoken with him. Here, to be sure, the two objects, our friend and this place, have been together; this contiguity was, however, not constant, but only accidental. This must have led the investigator to the further knowledge that in this, as well as in the former examples, the decisive point is not in the objective *being-together*, but in the subjective *being-seen-together*; not in the contiguity in space, but in the contiguity in time, — in a word, in the simultaneousness of perception. This new discovery, being approved by further trial, showed the first hypothesis to be insufficient. The latter had helped the investigation upon the track, but had not reached the goal; it was not entirely false, but the decisive point was lacking; it contained only half the truth, not the whole.

Of course it does not make any difference whether the Greek psychologist went to work in just this way or not; his investigation resulted in a classification into four kinds of relations. And, as a matter of fact, all cases of recollection, however varied they may at first view appear, may be divided into these four categories, as any one can try for himself if he will take the trouble.

These four forms of recollection are as follows: —

1. *Simultaneously* formed ideas reproduce one another. (Examples above.)

2. Ideas in *continuous series* reproduce one another, — most easily in the order in which they were formed. Examples: The words and sentences in a selection committed to memory; the stations and stages in a journey; the events in a story that has been heard or read; the occurrences in one's own life, etc.

3. *Similar* ideas reproduce one another. Examples: Like-sounding expressions, as in rhyme and alliteration; similar historical facts (thus David and Jonathan's friendship recalls that of Damon and Pythias; the giving of the law by Moses, the legislation of Lysurgus and Solon, etc.). Here belong also the cases in which a thought calls up a comparison; further, that reproduction which helps to form clear perceptions out of sensations, and that also which leads to the spontaneous formation of concepts and judgments, etc.

4. *Contrasted* ideas reproduce one another. Examples: The sight of great luxury and waste reminds one of poverty and misery; a deed of distinguished courage recalls an example of cowardice; great goodness of heart, an instance of hard-heartedness; the downfall of Prussia in 1806, its uprising in 1813; Germany's political unity since 1870-1871, its previous distracted condition; the cradle, the grave, etc.¹

This was an important beginning in the illumination of such an obscure field as that of the movement of ideas, and redounds to the honor of the great Stagirite. This performance is all the more remarkable because in all sciences it is the first steps that are the most difficult; but still more because of the fact that psychological investigation during the succeeding two thousand years did not make any essential progress in this regard.

Those four laws of recollection are, as without doubt their

¹ Whoever wishes to get any real good out of these four laws for the association of ideas must not omit to observe his own thoughts as they occur to him off and on, and see under which rule each separate case belongs. In the study of psychology, that which is learned should be applied on and on to the phenomena of one's own mind, since nothing can take the place of self-observation. For exceedingly interesting suggestions see Galton, *Human Faculty*, p. 182-207.

discoverer also knew, only *symptomatic*, not *causal*. They say *that* the ideas reproduce each other in these four ways, but they cannot say *why* they must do it; wherefore, also, it remains unexplained why there are just four ways, no more and no less. But aside from this chief omission, of which we shall speak later on, the Aristotelian theory of memory is also symptomatically incomplete, although not absolutely wrong. Since Descartes (died 1650), this incompleteness has been remedied. And this has been the only scientific addition to the doctrine of memory until the present century. Herbart (died 1841) gave a new impetus to psychology in every department, and has justly been called the father of modern psychology. It is this recent work, more particularly in the physiological field, that has contributed most toward a solution of the cause of the association of ideas. The addition made by Descartes was this. He recognized that, on the one hand, the first and second, and on the other hand, the third and fourth, laws (as stated above) have so much in common, that probably each pair forms a single law.

In the first pair the deciding characteristic is the time; more exactly, the circumstance that the two ideas in question have been in consciousness together, either at the same time or immediately succeeding each other. There is no reference to the content of the ideas. They may be derived from different senses, or from the same; and in the latter case they may be like or unlike, and it makes no difference. If, now, both laws require a previous co-existence of the ideas in consciousness, while they differ only as to whether the ideas are completely simultaneous, or whether one idea has already become partly obscured when the other enters consciousness, — or, in other words, whether the two ideas

have been together in consciousness a longer or a shorter time, — it is clear that in both cases the reason of reproduction must be sought in the common characteristic of having been together in consciousness. Accordingly, these two laws are to be understood only as one, which may be called the law of *simultaneity*. That which had previously misled into thinking that there were two laws proves to be merely a difference in the effect of one and the same cause,

namely, the being in consciousness at the same time, — and in the main only a difference of degree, since the completely simultaneous ideas are more strongly united than the half simultaneous.

The other pair (3. and 4. laws p. 42) differ from the first pair in two ways. First of all, the matter of time does not come into consideration here at all, since the ideas need never have been together in consciousness. And in the second case, that which before was not considered — namely, the *content* of the ideas — is here the distinguishing characteristic; for the expressions “similar” and “contrasted” refer to the content of the ideas. Keeping this in mind, one cannot help wondering why in the one case the similarity, in the other case the dissimilarity, of meaning should cause reproduction. It was plain that there must be some mistake. It was soon recognized that in the latter case the earlier psychologists had allowed themselves to be deceived by outward appearance. A contrast between two objects presupposes their similarity in other respects. For between two entirely dissimilar or disparate ideas there can be no contrast, because, as we say, they cannot be compared. Thus, for example, such ideas as have their origin in different senses, as square and sweet, red and shrill, etc.; likewise, round and yellow (form and

color), although they come from the same sense. Since, then, in the third law it is plainly only the likeness that causes the reproduction, it might easily be guessed that also in the case of contrasted ideas it was their like characteristics that made one reproduce the other, and that only after this had so far taken place the contrasted characteristics attracted attention. This was proved to be true by the fact that ideas completely unlike never recall one another, unless they have been in consciousness simultaneously, in which case the law of simultaneity alone holds. From which it follows that the 3. and 4. laws are likewise to be regarded as one, which may be called the law of similarity. That which had previously misled into supposing that there were two laws, — namely, the consciousness of contrast, — proves to be merely a difference in the effect of one and the same cause, and really only an *after-effect* of the reproduction that has already taken place by reason of similarity.

Thus a deeper examination has shown that the fundamental laws for the manifold forms of reproduction are considerably simpler than was formerly believed. There are not four laws of memory, but only two; that of *simultaneity*, and that of *similarity*. In the first a subjective factor decides, — namely, the previous presence of the ideas together in consciousness; in the second, an objective factor, — namely, their similar content.

These two laws, then, simple as they seem, are only symptomatic, and do not yet express the cause of reproduction. Modern psychology, physiological and experimental, has been fruitful in suggestions of solutions for this question. When we recall to mind an act we have done or a sensation we have experienced, the similarity between this and

the original doing or feeling is so great as to leave but little doubt that the same parts of the nervous system are concerned in the mental reproduction as in the previous physical production. We know that every action leaves the parts of the body with a disposition to the same action again, thus making the second performance more easy. This fact lies at the foundation of habit, and it would seem the same fact is the basis of memory.

Thus, then, we may conclude that the senses are not only necessary to receive impressions from the outside world, but are also necessary for their vivid reproduction in memory; the muscles of the body are not only concerned in the movement of parts of our organism, but they also play a part in the remembrance of these actions afterward. The memory, therefore, has no seat in any particular part of the nervous system, but is everywhere. There are as many species of memory as there are species of representation. Mental work is also nerve and muscle work.

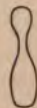
This being so, we can easily appreciate the fact that the nervous discharge, when once started on a previously travelled tract, continues till it has roused all those cells to action which took part in the first process. Or, to put it more plainly, if one portion of a previous mental state returns to consciousness, the entire state, with all its accompaniments, will naturally be recalled, provided only the nervous energy is sufficient. As Professor Lazarus of Berlin expresses it, "Every state of consciousness tends to reproduce itself completely." That this law has its basis in the anatomical structure of the brain and nervous system, we can hardly doubt.

This is evidently also only another statement of the foregoing law of simultaneity. For whatever ideas, feel-

ings, or volitions may be in the mind at any one time fuse together into one state; there is strictly only *one* complex idea in the mind at any one time. The very fact that two or more ideas, etc., are in the same moment in the same consciousness, unites all of these into one state. They are not separate ideas, feelings, etc., until they have been thought of at *separate times*; i.e., in separate consciousnesses. *We have, therefore, in this one statement the cause both of our mental associations and of our mental abstractions.*

We have next to explain the cause of associations by similarity. For the sake of clearness, I shall make use of a very simple concrete illustration. In the margin is a very meagre outline, say of a *vase*. Ask a shoemaker what it represents, and he will probably, if pressed to say something, declare it is a *shoe-sole*. If you ask the same question of a biologist, he will probably say it represents a *cell* of a yeast plant, with a daughter cell budding off from it. Ask now a little girl, and she will say it is the head and body of a *doll*. A boatman will say it is the outline of some *island* he knows. An Indian recognizes it as a representation of a canoe *paddle*; a chemist sees in it a laboratory *flask*; a geometer sees two *ellipses*; a German is reminded of *nine-pins*; while a gymnast sees a suggestion of an *Indian club*. This might be continued indefinitely, but enough has been shown to illustrate the working of the law of similarity.

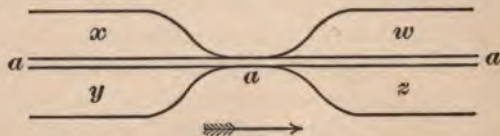
That which remained *constant* in all of these associations is the rough outline on the paper; but in each case it called up in mind a different *complement* of accessory ideas, thus completing for each of these observers a different previous mental state. It is evident that in thus



redintegrating previous states of consciousness the same process was taking place as was before described as association by simultaneity.

Let us take one step farther. The same person looking at the above figure would no doubt be reminded of different objects (successively, just as we have supposed different persons to be). In other words, one of these objects would suggest the other *through the medium of the outline*, which is *common* to both. Now, this illustrates very clearly, I take it, what occurs in the case of every instance of association by similarity. Consciousness concentrates on certain elements, — namely, on those through which the association is made, and which are therefore *common* to both ideas; thereupon by the law of simultaneity the other parts of that second previous mental state are recalled. It is in this way that the mind passes from one complex idea to another by *simply retaining those elements common to both*, and then (1) *dropping out of consciousness the other elements of the first idea*, and (2) *redintegrating the second*.

The process may be represented diagrammatically as in the figure. The flow of consciousness is represented from



left to right. The complex idea, containing elements represented by *x*, *a*, and *y*, is now in mind. The attention is then concentrated on the one or more elements represented by *a*, which therefore simply *persist in consciousness* after *x* and *y* have dropped out. The elements *a* have, however, already formed an integral part of a previous state of con-

sciousness in which they were associated with w and z . They therefore now reproduce w and z by the law of simultaneity and the second complete idea results in consciousness.

Thus we see the process of recollection by similarity reduces to redintegration by simultaneity, and the latter is therefore stamped as the original law of association. The only way in which two ideas can be immediately associated is by their forming parts of the same mental state at some time. On the other hand, since two similar ideas are associated *through* their common elements, we might call such association mediate, in contrast to the immediate association of two ideas by simultaneity. This use of terms, as well as the entire preceding explanation of association, is of course very far from being Herbartian.

Here, then, we have the two laws of memory in their very inmost nature and causal connection before us. Notwithstanding, however, their identity in origin, the two ways are, psychologically, essentially different in their influence on the development of the mental life. They are distinct ways of reproduction, and without the recognition of this fact the higher activities of thought are inexplicable. One individual never goes beyond outer connection; his memory for facts appears marvellous; we wonder "how one small head can carry all he knows"; his stories are filled with minutest unimportant details, apparently having no connection but that they once happened in that order. Another person does not seem to know half so much, but brings every fact into its logical connection. When he tells a story, only such details as have relation to the main issue are brought in; his memory makes no great show of power, but always seems to be readier in an emergency than the

other man's. But the greatest difference of all is, the latter *understands* things better than the former. "To the peasant the falling apple redintegrates only spatial associations of its pleasant taste; to Sir Isaac Newton its resemblance to all falling bodies suggested the law of gravitation."

The difference in mental economy is shown by the relative availability of a fact remembered by association with another fact in time or space; and, on the other hand, of a fact remembered by its relation of similarity with others. For future use the former is frequently as good as worthless. It is bound up with other ideas with which it may never again need to be in connection. Except in those cases where the same processes or events are repeated over and over again, such memory has practically no use. It serves us, to be sure, in remembering that the sun rose in the east and set in the west, yesterday, day before, and so on. It must even be admitted that it forms the basis of all memory, as we have shown above; and it has truly immense importance for automatic action and all the mechanism of the mind. But it cannot be too emphatically reiterated that this sort of memory *alone* never can amount to anything. All mental power of thought, invention, imagination, and character itself depends on the workings of the other law (of similarity). The connection of similarity is internal, and involved in the very nature of the ideas. With the formation of every new link of similarity the capacity of the mind is increased instead of becoming taxed. But its greatest point of superiority is in the *availability for all future use of ideas so associated*. Wherever needed, there is just where they put in an appearance. They spontaneously group themselves in order, and prepare

the way for all the higher activities of thinking. As we have before seen, this process of spontaneous grouping leads to conception, judgment, and reasoning. The birth of all new ideas, plans, inventions, discoveries of nature's laws, etc., are alone made possible by the association of ideas by similarity. All science, both of investigation and of formulation, consists of applications of it.

It should be noticed that in the process of recollection, as just described, the first step consists in *dissociation*; i.e., in separating certain elements from the rest of the first complex idea, which then drops out of consciousness. The power to do this requires practice, and is of the same nature as *abstraction*. This breaking up of the ideas into their elements, however, must take place in order to make the ideas mobile, and to dissolve their connection in time and place, and introduce them into new combinations with other ideas like themselves. Readiness of thought depends on this ability; and both steps, *dissociation* and *redintegration*, need practice. In early childhood the facts of the external world pour in through the senses, leaving no time to sort out and classify. The association fibres that are probably necessary for the latter process do not get their medullary sheath and begin to function for a considerable time after birth. The foundation of all future greatness is, however, being laid in this great store of concrete material received through the senses and retained by sheer force of natural memory. Happy the child whose mind has been furnished thus abundantly. This is the raw material of school instruction that must be supplemented where deficient, and worked over into the higher products of thought. The method of school-work should therefore form the transition from the one form to

the other; from memory by simultaneity to memory by similarity, from childish wonder to maturer thought and understanding.

The question of resolving the two laws of memory into one principle has occupied nearly all the psychologists of note. Dörpfeld, differing from the above views, follows Herbart in his metaphysics of the statics and dynamics of ideas, and hence sees in the law of similarity the ground for the removal of the check from all the similar ideas which therefore *rise in consciousness of themselves* (1). Repetition is the assistance by which ideas which are not thus freed from check can be dragged into consciousness (2). This explanation of the two laws is concurred in by nearly all the Herbartian writers. The recent translation of Ufer's *Introduction to the Pedagogy of Herbart* contains the shortest unvarnished statement of these views in English (particularly pp. 12-14). See Herbart's *Psychology*, pp. 11-16; Lindner's *Psychology*, p. 81 ff.; and two articles by G. F. Stout in "*Mind*" on "*The Herbartian Psychology*" (Nos. 51 and 52). For a good short account with criticism, see the chapters on Herbartian Psychology in Ribot's *German Psychology of To-day*, pp. 24-67.

Spencer seeks on another basis to reduce simultaneity to similarity. To him the essential fact in association is fusion of similars in recognition. Coexistent ideas are similar in their time relation and hence associate. *Principles of Psychology*, i. p. 267 ff.

On the other hand, Lazarus in Germany, and Sir William Hamilton and others in England, and Dewey, James, Ladd, and Baldwin in this country, agree in the explanation given in the text, reducing all association to the principle of coexistence in consciousness. See Dewey, *Psychology*, pp. 90-117. James, *Psychology*, i. p. 578 ff., is very clear and readable. He adds that our general retentiveness is unchangeable by any amount of training (i. p. 663 ff.). On i. p. 594 he gives an interesting "history of opinion concerning association." For a similar brief summary of opinions, see Bain, *Mental Science*, Appendix, pp. 91, 92; and Sully, *Human Mind*, ii., Appendix, pp. 339-342. Ladd (*Psychology, descriptive and explanatory*, p. 275) says, "the influence of contiguity in consciousness is the sole discoverable psychological principle of association." Baldwin

(*Handbook of Psychology, Senses and Intellect*, p. 201) formulates the primary law as follows: "Every association of mental states is an integration, due to the previous correlation of those states in apperception." But one has to read the context to see what all of this means. Kay (*Memory, What it is and how to improve it*, p. 278) agrees in recognizing contiguity as the one principle of all association, but fails completely when he comes to explain it.

John Stuart Mill is of the opinion that the reduction of the two ways of association to one principle must be necessarily unsuccessful (James Mill's *Analysis of the Human Mind*, p. 111, note 35 by J. S. Mill). Höffding (*Outlines of Psychology*, p. 158) recognizes this as the fact, but identifies the association between the parts and the whole as the typical form of all association, which he calls the *law of totality*. Sully (*Outlines of Psychology*, p. 287 ff.) describes the phenomena in very much the same way, although he does not undertake to formulate any general law.

For an admirable historical account of the psychology of memory, see Dr. Wm. H. Burnham's articles in the *American Journal of Psychology*, vol. ii. A very complete bibliography of memory will be found at the close of these in vol. ii. pp. 614-622.

For dissociation of ideas, see Dewey, *Psychology*, pp. 117-129.

For the physiological basis of memory, see Spencer, *Psychology*, i. p. 270; and author's preface to Kay's *Memory* and pp. 29-46 and 92 ff.; James, *Psychology*, i. p. 643 ff. is clear and readable as usual. Perhaps the most accessible and clearest explanation of recent theory of physical basis for the association of ideas is contained in Ziehen's *Introduction to Physiological Psychology*, chapter ix.

See also Bain, *The Senses and the Intellect*, p. 338, for his famous doctrine that "the renewed feeling occupies the very same parts, and in the very same manner, as the original feeling."

B. OF THOUGHT.

The term law is applied to thought in two senses: we speak on the one hand of psychological, and on the other hand of logical, laws of thought. In the first case the term law is used in the same sense as in all the natural sciences, namely, to describe the actual, uniform, and invariable pro-

cesses of nature. Such laws allow of no exception. On the other hand, the laws of logic, like those of grammar, æsthetics, ethics, music, poetry, etc., are rules laid down by Art to be followed in order to secure a right result. The laws of Science *must be* followed if there is to be any result at all. The rules of Art may be and often are disregarded, and this results only in *mistakes*. Since our investigation is a psychological one, we have to do only with the psychological laws.

In order to simplify our problem, we must try to reduce the fourfold activity of thought under one point of view. In the second chapter above, the four forms of thought were reviewed: comparison, conception, judgment, and reason. It is usual to mention only the last three. The reason for this we shall see presently.

I should like to ask such of my readers as have been to normal schools or have already privately studied a compendium of psychology, just to try whether they can themselves reduce those four operations of thought under one head. This problem, belonging as it does to the theory of knowledge, which is the plainest and best-worked field in psychology, would indeed be very well adapted to show how much, or rather how little, good can come from compendiums. I shall attempt, however, first to make the problem plainer by a few separate questions. In what relation, genetic or logical, do these processes of thought stand to one another? Is one preliminary to another; that is, does one prepare the way for another? And if something like this is found to be true of some, is it further true of all? Do these four processes form a single genetic series, one arising out of another? In a word, when rightly understood, are there really four thought pro-

cesses, or three, or two, or only one? Even with these suggestions the reader will probably not be able to answer, especially if he has studied his logic diligently. The books on psychology, and especially the handbooks, leave their readers entirely too much in the lurch in this regard. They do not even present this problem, nor so much as call attention to the fact that there is such a problem. But worse still, they usually treat of three thought-processes in the order in which they are treated in logic. Now, logic is right in its treatment; for, since it has to do merely with the forms of thought, not, however, with their origin, it proceeds very correctly from the simple to the complex, and treats accordingly first of the concept, then of the judgment, and then of the syllogism. If the text-books in psychology choose the same order, it should be only as a preliminary treatment of each of these thought-processes by themselves. But if now they contain no further discussion of the genetic connection between the different thought functions, so as to correct the false order previously used, then not only is the chief topic in the theory of knowledge left obscure, but if the reader tries now to work this problem out for himself, he will be misled by the previous confusion of treatment. My own presentation in the second chapter above nevertheless follows the order dictated by logic, but the reason for so doing was simply for the purpose of showing the reader the contrast between that want of order and the genetic sequence which I shall now present.

For the sake of brevity I shall avoid the proper inductive form of presentation, and state at once the correct order of the thought-processes, leaving the proofs to follow in connection with examples.

In the first place, reasoning or inference drops out of the list of processes, on logical grounds. Because, as we saw before, reasoning is only a peculiar kind of judgment: it is the derivation of a new judgment from two or more other judgments, and the conclusion is therefore sometimes called a derived judgment. Therefore, leaving reasoning out of the list, we have still three specifically different processes of thought.

These three stand in a genetic relation to one another; i.e., they arise one out of another, but not in the confused sequence in which logic treats them. There is really but a *single thought-process*, which from its purpose may be called the formation of concepts; but it runs through *several acts*, just as in a flower the bud, the blossom, and the ripe fruit follow each other. The three acts in the thought-process are *comparison*, *judgment*, and *conception*.

Comparison is, for the present, to be counted as a separate act preliminary to judgment, in order to avoid any obscurity, or uncertainty as to its place in the thought-process. But, in point of fact, comparison and judgment really form but one mental act, or, in other words, they are only two different expressions for one and the same process, which in each case is regarded and named from a different standpoint. The word comparison regards the beginning of the process; the word judgment, on the other hand, has reference to its end, denoting, as it does, the result of the comparison. Or, in other words, comparison represents the process from its objective side, pointing to the two or more objects in consciousness whose like or unlike characteristics are to be sought; judgment, on the contrary, shows the process from its subjective side, referring to the peculiar form of idea produced. Now, in order

to have a single expression for this one mental process, we call it, from its result, by the name of judgment. In this psychological sense, to judge is, therefore, nothing more than to call up clearly in consciousness a distinct mental representation or idea of the object to be judged, together with those characteristics, wherein it is like or unlike another object. If the act of judgment is completed, the formation of the concept follows of itself. But this latter is not to be confused with the verbal expression for the concept. Nor can the reader be too careful in distinguishing the above use of the word "judgment" in the psychological sense from the usual definition of judgment as given in logic. Accordingly, we may say in conclusion: —

There is only a SINGLE thought-process, but it takes place in two successive acts, namely, JUDGMENT and CONCEPTION.

In this statement we have the myriad forms of thought reduced to their greatest simplicity. Even popular usage in speech has long since expressed the fact that there is properly only one thought-process, and that it consists of the two acts, judgment and conception; and further, that with the completion of judgment the conception was ready of itself, and that, conversely, no concept was possible without previous judgment. Each of the two expressions is used promiscuously in popular language for the whole process. For, when one wants to express the fact that another does not understand a certain matter, one may say either "he has formed no *judgment* in regard to it," or "he has no *conception* of the matter," and they both mean the same.

However welcome the foregoing general view of the process of thought may have been to the reader, such

knowledge must still remain subject to all of those faults that are inseparable from instruction by abstract ideas which do not rest on a concrete basis of careful observation. It affords, at best, very incomplete satisfaction to have a broad, open field of view and yet not be able to see clearly and distinctly anything in it. There is, besides, much more that requires explanation, particularly in the relation between the two parts of the thought-process. With the help of the concrete examples let us now attempt this further work.

For the correct understanding of the following examples, it is necessary that the two directions of thought be first properly understood. In comparison or judgment we may, of course, look for either similarities or dissimilarities in the object compared. Just according as we look for the one or the other, will the result be a different kind of concept. For instance, if the characteristics common to a right-angled, an acute-angled, and an obtuse-angled triangle are combined, the concept "triangle" is formed, which in respect to the three ideas above (so far as these are themselves concepts), is called a superordinate or generic concept. If, however, this concept were already formed, and in a new comparison of those three figures the dissimilar characteristics are seized upon (which process we call distinguishing them), there result finally the three differing ideas: right-angled, acute-angled, and obtuse-angled triangle. These, in respect to the concept "triangle," are called subordinate or species concepts. This shows us that thought can move in two different directions; in one way it proceeds to ever wider, more general, and higher concepts; in the other way, it reaches ever narrower, more special, and lower concepts. In the one case, broad views

open up to us; in the other, we find exercise for our discrimination. It is well when one head can combine both abilities — far-sight and acuteness.

The following examples are mostly those of involuntary or spontaneous conception, because when concepts are intentionally formed the process is of itself somewhat more transparent. The question therefore arises, what is it that determines whether the spontaneous process shall take the one or the other direction. When the process is voluntary, the will determines by choosing the one or the other; but if it is spontaneous, the determination must come from some other source. This source is in the objects themselves. For, if the objects to be compared show more similar characteristics and seem so much alike that the difference appears unimportant, and therefore not worth considering, thought will proceed to the superordinate concept. If, on the contrary, the dissimilar characteristics exceed, or if one in particular succeeds in attracting special attention, then, although the likeness will be noticed, still the process will lead to the subordinate concepts. Thus we see that nature has, even in the spontaneous process, already provided for both directions of thought.

First Example (in the direction of superordinate concepts). The reader has only to call to mind what was said above in the second chapter on the origin of the concept "mountain" in early childhood. If the child has already once seen such an elevation, and then afterwards sees another, the concept "mountain" is in its inception forthwith present. Although a general idea has thus worked itself out of the two concrete ideas, the child has not been conscious of this inner process, and yet if, when he saw the first elevation, he was told that it was a mountain, he

would at the sight of the second undoubtedly exclaim: "That is a mountain, too." We may well be surprised at the fact that here the judgment already contains the word (mountain) expressing the concept. This certainly looks as if the judgment did not take place *before* conception, but rather as if judgment and concept were born *simultaneously*. But, if this is so, how could we claim before that judgment was a preliminary process to conception? And if it is not so, our concrete example seems to have brought us only further into the fog of uncertainty. But the reader will probably conclude, and rightly too, that the example was nevertheless purposely chosen. The purpose was to call attention to an important peculiarity in the spontaneous formation of superordinate concepts, a peculiarity which is usually not even alluded to in the text-books. This example by itself, however, will not give us any full explanation. We must therefore first take an example from the other direction of thought, in which judgment and concept appear strictly separate. After we have rightly comprehended the relation in the latter case, we shall be able to clear up the doubtful points in the first example, and find out the important peculiarity which it teaches in regard to the formation of superordinate concepts.

Second Example (in the direction of subordinate concepts). Suppose a child has repeatedly seen yellow wood-sorrel (*oxalis stricta*). Of course there are different kinds of wood-sorrel, but we will suppose that he has not yet noticed their differences. Since, however, he has seen various specimens of yellow wood-sorrel, his mind has formed from these concrete ideas (percepts) likewise the abstract idea (concept) "wood-sorrel." If after this he comes across a specimen of violet wood-sorrel, he will notice

of course that it is similar to the wood-sorrel he has previously seen, but at the same time his attention will be attracted by the strongly different characteristic of color. The comparison and distinction is forthwith completed, and at the same time the mental process of judgment is ready to give expression to itself in the words, "this wood-sorrel is violet." — What do we find here as the result of the comparison? At all events a judgment. But is there not also a new concept — the species concept "violet wood-sorrel"? That there is no such concept in the judgment is shown by the fact that the new idea appearing in the predicate is nothing more than a *characteristic* (violet). But, it may be asked, does not the species concept "violet wood-sorrel" come into existence along with this new characteristic? For the present it does not; for the single specimen of this species that the child has seen can only give rise to the concrete idea or perception "violet wood-sorrel." In order for an abstract idea to be produced (in this case, the spontaneous species concept "violet wood-sorrel"), it would be necessary that several specimens of this species should first be seen.¹

The relation between the act of judgment and the formation of the concept will now probably be somewhat clearer to the reader. The judgment indicates as the result of comparison nothing new more than a new characteristic, but not yet the species concept, to which this characteristic belongs. It prepares the way, to be sure, for this concept, since it furnishes the new material (the

¹ Of course it is not necessary that several *different specimens* should be presented to the senses, but only that several different percepts or mental presentations, whether obtained from one or from more than one object, should have taken part in the formation of the concept

characteristic) for it; but the judgment as such knows nothing of the concept itself. It is clear, therefore, that here, in the formation of subordinate concepts, the judgment certainly comes previously to the concept—not simultaneously, as seemed to be the case in superordinate concepts.

It is, furthermore, important to notice that, as was just pointed out, the judgment *prepares the way* for the species concept; for, just as soon as the newly noticed difference "violet" has been distinctly apprehended, or, in other words, as soon as this new characteristic appears in consciousness in the form peculiar to the judgment, the concept wood-sorrel which was already present becomes *unsettled*. Why? It previously contained the characteristic "yellow," since this characteristic had occurred in all the specimens previously seen, and was therefore counted in with the common characteristics. But now, after a violet wood-sorrel has come to view, it is seen that this characteristic "yellow" does not belong to the common characteristics of this genus. What result has this on the old concept? First of all, that the concept "wood-sorrel" loses the characteristic (yellow) that did not belong to it, and becomes in so far purified and more complete. And secondly, that beside this earlier concept (wood-sorrel) on the one hand, the ready formed subordinate concept "yellow wood-sorrel" arises; and, on the other hand, the way is prepared for a second subordinate concept "violet wood-sorrel," co-ordinate with the other.¹

¹ The way is prepared for the second concept but it is not yet formed. This must be distinctly noticed; for the judgment as such never helps in the formation of concepts at all in any other way, since it does nothing else than furnish characteristics. This is just as true of the formation of

The second example has therefore shown us, first that the judgment always comes before the concept, and cannot come otherwise; secondly, that the act of judgment, when it relates to a dissimilar characteristic, has the effect of clarifying the old concept and splitting it into two sub-concepts, thus making it a genus concept.

We can now return to our first example and clear up the doubts that surrounded it. Why was it that in this first example judgment and conception appeared simultaneous? If in comparison, as we know, the mind is concerned only with like or unlike characteristics, and if the mental act of

higher as of lower concepts. In the present case, in the judgment, "this wood-sorrel is violet," there is another circumstance that will serve to show very plainly how strictly separate the act of judgment is from the act of conception. For here the characteristic "violet" appears as a point of dissimilarity in contrast to "yellow;" but a concept, on the other hand, is always concerned with common or like characteristics only. From this it follows that the judgment alone could never give rise to the concept "violet wood-sorrel," but that, as before said, several specimens of violet wood-sorrel must first be seen. Only after these have been compared can the characteristic "violet" be recognized as common. The new judgment, "all these wood-sorrels are violet," will now lead to the sub-concept "violet wood-sorrel." The earlier judgment in which "violet" was an unlike characteristic, has, therefore, strictly speaking, not directly prepared the way for this sub-concept, but only indirectly, and therefore not so much prepared the way for it as merely served as an incentive to its formation. The other sub-concept (yellow wood-sorrel) did not need any new judgment, since it was already contained in the old concept "wood-sorrel." This old concept experienced a change in its content, in losing one of its characteristics; its previous content, on the contrary, then became the species concept. This illustrates very nicely that mutual influence between new and old ideas, which is so characteristic of all apperception.

One thing more should be noticed here. Since a concept, whether higher or lower, is in comparison with the ideas which it embraces in its content, in the relation of superiority to these, it follows, therefore, that in the act of conception as such the movement of thought is always *upward*. The two movements of thought spoken of in the text are therefore found in judgment (comparison) only.

judgment is nothing more than a mental representation of the result of comparison, then it follows that the predicate of a mental judgment must relate to characteristics only, whether like or unlike. If, on the contrary, conception consists of seizing together in the grasp of a single idea the similar characteristics, then it must be plain that judgment and conception are two entirely distinct acts. If, then, in our first example this distinction did not clearly appear, it was owing to one or both of the following causes — either to a peculiarity in the spontaneous formation of genus concepts, or to the interference of language.

In order to have a concrete instance in mind, let us return to the example (mountain) given above. Here the characteristics which the objects compared with one another had in common, are several in number, as is also the case in most instances of such concepts. A child will never be able at the first sight to notice distinctly all of these characteristics separately; even an adult would not succeed in a single rapid glance. Now, just as the child has formed only a general perception of each of the two objects, so also of the characteristics in which they are alike. He perhaps has the general impression that the two objects are similar, i.e., have much in common, but he cannot give an account of the characteristics which compose this similarity. Suppose, however, for the sake of argument, that a child really had apprehended distinctly all the common characteristics, or at least some of them; still, he would scarcely have at command the necessary expressions to denote each of these characteristics precisely. But even supposing he had, the child would have no incentive to express these common characteristics in a series of separate judgments. What concerns him is simply to make known

the *general impression* that the two objects are *similar*. For this purpose the easiest means that offers is the name of the elevation first seen — the word “mountain,” which when first heard had for the child the meaning of a proper name.

This shows us clearly whence it comes that the expressed judgment, “that (thing) is a mountain,” already contains the *concept word*. The expression, mountain, which the child uses in the predicate is, for him, not a concept word, but a mere name, the name of the elevation first seen. He means to denote by it the characteristics he has noticed (in this case those that were common to both). Since, however, only the total impression was noticed, or in case any one of the characteristics was distinctly noticed, the particular expression for it was wanting, he therefore chooses the name of the object previously seen, as much as to say: the characteristics which he has now in mind here, are just the same as he had before seen there: or, in other words, since the two objects have so much *in common* (judgment), they deserve the *same name* (concept). If the meaning of the child's expression is so understood, we see plainly the relation between the act of judgment and the formation of the concept, although in the actually spoken judgment both acts were mingled. The child's manner of expression accords with his incomplete apprehension and his poverty of language. For, because the mental act of judgment is not correctly completed, and because, moreover, the correct expression is wanting, while the idea is, nevertheless, struggling for utterance; the genuine judgment form which ought to give the separate characteristics is, as it were, skipped, and that form is chosen which the judgment has when it comes after the

concept has been formed, and when it therefore is intended to name, not the separate characteristics, but the concept itself. This is probably the correct view with reference to nearly all those charming instances of childish "extension of meaning" in common words, which are frequently given as proof of the child's power of abstraction and conception. One little girl, born in the South, saw snow for the first time on a visit North, and said it was "raining soapsuds." Another called the crackling of the kitchen fire, "barking." A little boy, not yet old enough to pronounce distinctly, called dipping bread into gravy giving it a bath ("bä'"). Baby J—— used the word "bo" to mean anything that pleased him. Darwin's little boy, at twelve months, invented the word "mum," which he used for food of all kinds. There is no proper abstraction in any of these cases. A child of one or two years old uses words by analogy, as was explained above, but does not have general concepts with any definite content.

Adults, moreover, do not do a particle better than the child in the spontaneous formation of genus concepts. When they pass a judgment merely on the basis of a hasty comparison, without, therefore, distinctly apprehending the separate common characteristics, they understand very well how to cover up this deficiency. They pass by the genuine form of judgment and employ, instead, the expression which contains the ready formed concept, and perhaps, besides, use a very *general expression* for this concept. And this phrase must pass current for a genuine judgment, and the general expression must serve as an adequate concept. Sometimes such a word serves the purpose for which it was uttered—just as light money passes for full value until its deficiency is recognized.

Thus we have shown that likewise, in the case of superordinate concepts, there results from the comparison first of all a judgment, no matter whether expressed or not. But the judgment never concerns itself with anything but the separate characteristics; for the mental act of judgment is nothing but the focusing of consciousness on a single like or unlike characteristic. To sum up: not until the judgments are made, that is, until the necessary like or unlike characteristics are seized upon, thus bringing together the material for the concept in question, — not until this is done, can the concept, whether superordinate or subordinate, be formed. For conception is nothing but the taking together (*con*, together, *cipio*, I take) of the common or essential characteristics in the grasp of one idea. In just so far as the preceding judgments have been incomplete, will also the succeeding concept be incomplete. A concept deserves to be called scientifically precise, only when it is the result of *correct* and *exhaustive* judgments.

The manifold forms of thinking have thus been so far simplified that we see they consist entirely of judging and forming concepts, — or of the two successive acts: apprehension of the separate characteristics of several objects, and comprehension of their like or essential characteristics in the grasp of a general idea. There is, moreover, nothing to prevent carrying this simplification farther and denoting only the final act, and saying, accordingly, *to think is to form concepts*. But one must then keep in mind that this concluding act is preceded by the preparatory act of judgment.

A further hindrance to the clear understanding of the genetic relation between judgment and conception lies in the use of language. Since the text-books make no men-

tion of this difficulty and no attempt to remove it, we shall try to supply the omission.

Language is in this respect by no means a true mirror of the mental processes. Thus the concept, being a single idea, would require, as a corresponding expression for itself, a single word or a word with one or more qualifiers (e.g., right-angled triangle, bitter tasting, beautiful and correct writing, "the little village of Grand-Pré, distant, secluded, still," as subject, "lay in the fruitful valley, in the Acadian land, on the shores of the Basin of Minas," as predicate, etc.). But in order to express any mental act, language never uses a single word or an isolated phrase — unless it be an abbreviation, in which the omission is supplied mentally — but always employs a sentence, which is the form of expression for a judgment. And since concepts always occur as parts of a sentence, any one who does not thoroughly understand the origin of judgments and concepts would be led to believe that concepts were developed before judgments. The reason why language obscures the correct sequence of these acts is not difficult to see. One has only to remember that the speaker puts his thoughts in words not for *his own sake*, but in order to communicate them to *others*. Thus, if one is thinking to one's self and wishes to denote in words a newly conceived idea, a *single word* will suffice, or an *isolated phrase*; but, if one wants another clearly to understand a newly conceived idea, such an isolated expression will not be sufficient, but the preceding act of judgment must be indicated. Now, this is done by formulating a complete sentence, in which the objects judged appear as subject and the resulting concept as predicate. For example, suppose the new concept is "parallelogram." If it has been gained from the study of the

square and rectangle, it has been preceded by the two judgments: "in the square the opposite sides are parallel," and "in the rectangle the opposite sides are likewise parallel." Hereupon the superordinate concept results which we briefly call "parallelogram." Now if this act of conception is to be made known to others, it takes place through the sentence, "Squares and rectangles are parallelograms." The same is true if the concept is not entirely new, but, although formed before, is not yet clarified and completed. Thus, in the case before us, if, in regular school work, the new concept "parallelogram" is to be tested and at the same time made complete — by application first to the rhombus, we will say — there will result first of all again a genuine judgment: "in the rhombus the opposite sides are likewise parallel." Hereupon the clarified concept appears in the sentence: "the rhombus is likewise a parallelogram." If, after the test has been further made with the rhomboid, the completed concept is now to be expressed in its full extent, the sentence would be: "the square, the rectangle, the rhombus, and the rhomboid are parallelograms."

In this way language clothes all thoughts in the sentence or judgment form; but, if one looks closer to see what sort of a mental act is thereby represented, one will find that there are two sorts of judgments as expressed in language. One kind expresses an actual mental act of judgment preparatory to the particular concept; the other kind properly makes known only a newly gained or newly completed concept, and such are therefore possible only after the concept has been formed. In the first case the language is adapted like a well-fitting garment expressly made to order; in the latter case, on the contrary, it is only a borrowed suit for

an emergency. Thus, although the fact that language uses sentences exclusively, may easily mislead the beginner in psychology into believing that the judgment forms the conclusion of the thought process, a closer examination has shown us that the contrary view is confirmed, viz., that conception is the end and goal of thinking. For further elucidation let the attention be called to a couple of examples which show that the act of conception towards which the judgment is aiming is very frequently not expressed at all, but instead only the preceding judgment. This is more particularly the case when the concept is in the main already formed and the new judgment only adds a further explanation. Thus, for example, the geometrical proposition, "the angles of a triangle are together equal to two right angles," is a genuine judgment. The act of conception, to which it tends, consists in the completion of the concept triangle by a new and accessory characteristic. The Pythagorean proposition is likewise a judgment in which the concept "right triangle" receives a new and accessory characteristic. In both cases it is the act of judgment to which we give expression, not the act of conception. The preceding discussion, which has, it is hoped, tended very much to simplify our conception of thinking, has likewise simplified our search for the psychological laws of thought. We have only to concern ourselves with judgment as the preliminary act, and with conception as the final and chief act. The psychological law is here to be understood as meaning the cause or incentive which leads the mind spontaneously (involuntarily) on the road to judgment and further on to conception. We must therefore watch and observe unintentional or spontaneous thinking, since intentional or scientific thought is influenced by

the will. We will begin with conception, since we can from this higher point of view look back better over the preliminary act.

We must, then, briefly recur to the process of conception as before described in the second chapter. When a concept is to be formed, two or more ideas, having something in common, must be present side by side in consciousness. There are three possible cases: in the first, two objects may be immediately present to the senses, e.g., if the teacher draws two geometrical figures on the board, or distributes two different kinds of plants to the class. Secondly, one idea may be a sense perception and the other a reproduced idea, e.g., if the mountain one is looking at recalls the image of one previously seen. Thirdly, both may be reproduced ideas, as is mostly the case, for instance, in silent meditation. The concepts in these cases are so-called class concepts, because they include in their extent a number of objects. The individual concept differs from these in referring only to a single individual (person, thing, etc.). But in its origin it does not differ, since the individual must have been seen several times and in different forms, e.g., a person in different clothes, or at different ages, in different mood, activity, etc. Here, only the second and third cases above mentioned can occur — the last, when, for instance, an historian meditates on the essential characteristics of an historical character, whose biography he has read.

The process of conception always consists simply in those characteristics which the two objects have in common becoming clearer in consciousness, and the dissimilar characteristics consequently being crowded back, i.e., becoming indistinct. The former make up the content of the con-

cept. It is possible that the like characteristics at first have not been all distinctly marked, but only in the form of a general impression or feeling, as people usually, but very improperly, say. Nevertheless, even in such case, the concept is already embryonic. The cause of the act of conception is, accordingly, the fact that the *common characteristics become clearer in consciousness*, since each pair of characteristics corresponding to the two ideas compared unite into one and are thus strengthened. This is then the psychological law of conception which we have been seeking.¹

The next question is whether this is the only law, or whether there is another in conjunction with it. There is, indeed, as we shall see, a second law in all those cases where one or both ideas are reproduced in memory. For in these cases the meeting of two ideas in consciousness is made possible only when an idea, momentarily in consciousness, recalls to mind an earlier similar idea. Thus we see that here the memory is actively engaged in the service of conception, and we may therefore say, that in all those cases where the ideas compared are not sense perceptions, the law of reproduction by similarity assists as a preparatory factor of thought. The first case above, in which this assistance is not rendered, since the objects are presented to the senses, occurs comparatively seldom, — and for the most part only in regular school instruction, in which case the process is intentional, whereas we are here speaking of spontaneous conception. The other cases em-

¹ Concepts, therefore, bear a striking analogy to *composite portraits*. The term "abstract idea" is frequently not so appropriate as "cumulative idea." Compare Galton, *Inquiries into Human Faculty*, p. 83. Ribot prefers the term "generic idea."

brace not only by far the greater part of the processes of thought, but are further of special importance, inasmuch as through them the store of ideas already collected is continually being applied to the production of new thoughts; without them the older supply of ideas would remain as dead capital for the mind.

In order now to discover the natural cause that leads the mind to form judgments, we shall have to exclude from our consideration all cases of voluntary thought, since here the will too much overshadows the other natural cause for us to observe. And so far as involuntary or spontaneous thinking is concerned, it will again occur to the reader that here the act of judgment is skipped, as it were, i.e., does not show plainly, thus resulting in concepts which are likewise incomplete. Hence it would appear that the very process which we wish to observe is so obscured that our investigation seems to be brought again to a standstill. But we should recollect that those judgments which lead immediately to conception, relate exclusively to the *like* characteristics. Even if this half of the field is cut off from our view, there still remains for observation all the other half, consisting of those judgments which relate to *unlike* characteristics. These were already referred to above as giving the downward direction to thought, towards subordinate concepts.

One point is already clear to start with. Keeping in mind that a judgment is nothing but a peculiar kind of mental presentation, and, further, that the usual mental presentation can take place without leading to outward expression in language, we notice that there are two parts to be distinguished in the act of judgment. In the first place the apprehension of the characteristics in question,

whereby the ordinary form of mental presentation results; and, secondly, a certain additional factor that changes the ordinary mental presentation into the judgmental form. It is this second factor, then, that is properly the cause of the act of judgment, and is therefore the element that we are seeking. The following examples will show us wherein it consists.

First example: A child sees a white *sheep*, and at the same time, alongside of it, a piece of black *coal*.

Second example: The child sees a *white* sheep, and at the same time, alongside of it, a *black* one (supposing he has not seen sheep before at all).

The examples are evidently so chosen that the very same two unlike characteristics (white and black) occur in both cases. The question is now: What sort of a mental state will these unlike characteristics call forth in each case? Will they give rise to a judgment or not?

In the first example, what arise first in the mind of a child are the total perceptions of the two objects. There is certainly no doubt that the color characteristic will not be wanting in either one of the perceptions, since color, as is well known, belongs to the characteristics that seldom escape attention. We will, therefore, assume that the color characteristic has been apprehended along with the rest in each object, resulting in at least an ordinary idea. Will now this ordinary idea produce a judgment? At first view one might think that since these characteristics are in contrast, and their difference is so great that it could not be greater, they would strike the child as something noticeable, and so lead to the formation of a judgment. Nevertheless, I claim that the act of judgment will not follow, — which is as much as to say, that, in spite of the contrast,

the attention is not sufficiently aroused, and the apprehension has not been sufficiently lively, *to make the mind feel the need of giving vent to itself in a judgment.* Of course it would not be absolutely impossible in the case of an adult, although even here probably no judgment would arise; but in the case of a child in whose mind those two ideas meet for the first time, it is practically impossible. The two objects, sheep and coal, are so different in kind that they have nothing in common in respect to most of their characteristics; they are, therefore, aside from the single characteristic of color, incapable of comparison (disparate). Although there are two objects, they do not make a *pair*. The two ideas lie side by side in the mind, but, since their main elements have no relation to each other, they remain thorough strangers. They do not rouse each other, they produce no movement of thought, but remain indifferent, as if they did not concern each other at all. To be sure, the two unlike color ideas, being capable of comparison, could in themselves serve as a stimulus to each other, and particularly so since they are in contrast; but, compared with the excess of *indifferent* elements, this single stimulus is too weak to cause any result. If, then, in such a case, where the contrast is so great, no judgment results, there is still less cause when the difference is smaller.

Turning now to the second example, we find as before first of all the two total perceptions. But the rest of the mental process will be essentially different when compared with the first example. The two objects are so very much alike that they have all characteristics in common with the single exception of color. Accordingly, the two total perceptions do not remain as strangers, indifferent to each other, in stolid repose, but engage at once in inter-

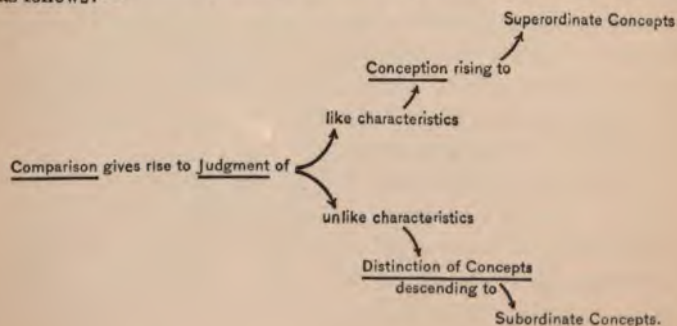
course as near relatives. Hereupon the law of conception begins to operate, and the similar elements coalesce in pairs. This movement of the like characteristics communicates itself to those that are unlike; they also approach each other, as it were, and feel the stimulus of rivalry to compare their content. In so far it looks as if the attention would be almost forcibly directed to the difference of those characteristics, and, therefore, that a judgment would now really result, and yet it is highly probable that such will not be the case. For the very same favorable circumstance that brought the two unlike characteristics together and stimulated comparison, viz., the commencement of conception, contains likewise a *hindrance* to comparison and therefore to judgment also; for, while according to the law of conception the common characteristics are coalescing, and therefore strengthening, the effect on the unlike characteristics is, as we know, to crowd them back in the same measure, to make them *obscure*, and therefore *withdraw them from the attention*. The advantage afforded the act of judgment by the process of conception thus seems to be lost. This case which at the beginning seemed to be so favorable will, therefore, as a rule, not lead to any conscious comparison of the unlike characteristics and therefore to no formal judgment. If one changes the example before us so that instead of two present perceptions only one is of this kind, and the other a past perception, and therefore now a reproduced idea, it is easy to see that, so far as the act of judgment is concerned, the change is not essential. We shall, therefore, not consider this case any farther, but shall proceed to a new example, in which, on the contrary, the act of judgment appears in full force.

Third example: Suppose the child has seen a white sheep not only once but repeatedly, so that the spontaneous concept "sheep" is already formed — so far as is possible from such observations. What will take place now in his mind when he one day happens to see a black sheep? Compared with the foregoing example we shall notice two points of difference, both of which are owing to the fact that the mind possesses an already formed concept, which is now recalled in consciousness. Although again an act of conception takes place, still it is only the application of an already formed concept and therefore proceeds easily and quickly, thus not occupying the attention so strongly as at first. While, therefore, on the one hand, the incentive to comparison of the unlike characteristics remains in full force, the accompanying hindrance, on the other hand, is weakened. This is the first advantageous change. The second point of advantage is as follows. Since all the sheep yet seen were white, and this characteristic was firmly impressed by the repetition, and even received into the concept as part of its content, the mind *expects to find* the characteristic "white," again, in case such an animal comes again to view. If now a black sheep appears, this expectation is disappointed. *This feeling of disappointed expectation* directs the attention with all its force to the unlike characteristic, draws the idea forward again more strongly into consciousness, and then gives vent to the judgment, "This sheep is *black*."

To sum up the results of our discussion thus far, we see that in the first example the apprehension of the unlike characteristics was not yet of itself sufficient to call forth a judgment, even when the difference amounted to contrast. What is further necessary is a stimulus to comparison; for

comparison is the characteristic act which begins the thought-process, or the decisive point of transition from an ordinary idea into a thought.¹ Only similar ideas afford material and opportunity for comparison; therefore, in the first example, since the objects were too disparate, no comparison was possible. The act of comparison begins uniformly with the like characteristics; because the impulse to comparison has its origin in the law of conception, whereby the similar elements coalesce, and this impulse begins to operate at once, as soon as the two ideas come together. The comparison of the unlike characteristics, on the contrary, does not begin until the process of conception has been concluded, because the latter process obscures the

¹ A new light is here shed on the important idea of comparison. It will be remembered that at the beginning of this section comparison was expressly counted as one of the acts of thought. Comparison is really the act out of which all the other acts of thought grow, just as the bud develops into the flower and fruit. First of all, judgment — on the one hand, of like, on the other hand, of unlike characteristics; hereupon follows conception — on the one hand (on the basis of the like characteristics), rising to higher concepts, on the the other hand (on the basis of the unlike characteristics), descending to subordinate concepts. In the form of a table these chief points in the thought-process may be represented as follows: —



differences and withdraws the attention from them. As an offset to this hindrance a new incentive to comparison is found in the above mentioned feeling of disappointed expectation. But this feeling is not itself the primal cause of judgments in case of unlike characteristics; for this feeling is a derived condition and points to a still earlier cause. There must evidently have been a *previous expectation* based on an earlier act of conception. This concept, on the one hand, when it appears as a reproduced idea in a new application, and the unexpected new perception, on the other hand, give rise to the feeling of disappointment. The primary cause of judgments in the case of unlike characteristics is, accordingly, to be found in the law of conception whereby like characteristics coalesce. It must, moreover, not be overlooked that the other factor of conception, the law of reproduction by similarity, is also at work here.

A few pages back (p. 73) we passed by the judgments formed in the case of like characteristics, because there the act of judgment was not easily recognized. Now it is not to be supposed that the act of judgment is really skipped, although this form of expression was before used. As a matter of fact, a judgment does really take place, but surreptitiously; because a concept can only be present when it has some content, and this latter can only consist of those characteristics which are recognized as common, even though they are not distinguished separately and precisely.

The primary cause of judgment in the case of unlike as well as in the case of like characteristics, is therefore one and the same, namely, the law of conception. The only difference is, that in the case of like characteristics this law serves as the only and immediate stimulus to judg-

ment, whereas, in the case of unlike characteristics, it first gives rise to that feeling of disappointed expectation, and thus operates through this intermediate factor.

There are three recognized forms of judgments, — affirmative, negative, and double, i.e., affirmative and negative. It will certainly not be uninteresting to the reader, if, in conclusion, we speak briefly of the psychological basis of this threefold form, even though this does not properly belong to our subject.

Negative judgments relate to characteristics that are missed, i.e., to such as are wanting, whereas previous experience has taught one to expect them. If, for example, at a season of the year when trees are usually covered with foliage, one comes across a tree without leaves, this naturally attracts attention and leads to the judgment, "this tree is not covered with foliage." Or, if one meets a man who has lost both his arms, one says, "this man has no arms." The negative judgment thus points out a vacancy or omission. Both of the other forms relate to characteristics that are not expected. Two cases are possible. The new characteristic may either supply an omission in one's previous knowledge, and therefore be compatible with it, or it may take the place of an expected characteristic, and in this case be incompatible with one's expectations. As an example of the first case, suppose a person does not know how many styles there are in the apple blossom, although he is otherwise well acquainted with this blossom. If his attention is called to it and he finds that there are five, this characteristic simply completes his previous knowledge, and does not conflict with any other character-

istic. There results, accordingly, the simple affirmative judgment, "the apple blossom has five styles." As an example of the second case, let us suppose a child as yet has seen only white sheep, but now comes across a black one. The new mark of color conflicts with the old. But to express this resulting state of mind, a simple affirmative statement is not enough; for both the new characteristic and likewise its *incompatibility* with the old must find vent. Hence arises the form, "this sheep is not white, but black." Thus the affirmative judgment relates to an unexpected, but compatible characteristic; the double judgment, on the contrary, to an unexpected, but incompatible characteristic.

Our investigation into the laws of thought is finished, and we have found that the two principal acts which succeed each other in the thought-process, namely, judgment and conception, however different from each other they may be, still are based on one and the same fundamental law: *the coalescence of the similar elements contained in the two ideas*. Only in the case of judgments of unlike characteristics, there is a secondary and additional cause: the feeling of disappointed expectation. How simple the causes appear in this field of thought, where at first the processes seemed so varied and complex!

The laws of thought, as well as the laws of memory, have thus passed in review before us. Let us now briefly compare the two results, in order to make definite the relation between these two mental activities.

In the case of thought we have here to do only with its

primary or chief factor, and therefore with but a single law; which is as follows:—

Thought depends on the coalescence of the SIMILAR elements of ideas; or, in other words, it is the SIMILARITY of ideas that determines thought.

The memory is controlled by two laws, either —

1. *By the SIMILARITY of ideas*, or
2. *By their SIMULTANEITY*.

If now we compare thought and memory with respect to these factors that underlie their processes, we see that both mental activities have one factor, namely, the similarity of ideas, in *common*. In the one case this common factor causes a *production* of *new material* through the process of abstraction and conception; in the other case, on the contrary, it results in a *reproduction* of *the old*. We may formulate this fact briefly as follows:—

THE LAW OF THOUGHT IS LIKEWISE ONE OF THE TWO LAWS OF MEMORY.

It will, undoubtedly, have occurred to the reader already, that this psychological truth must be of most immense importance in the work of teaching and education. This will show itself still more exactly if we examine the relation between thought and memory to see in how far these two mental activities re-enforce and serve each other.

In what way does memory act as the servant of thought?

This question has already been answered in the second chapter. The memory is, together with the activity of perception, the furnisher of the material of thought. But in this service it makes a very great difference whether the material is furnished according to the one or the other

law of memory. By the first law of memory similar ideas are supplied, and therefore a material which immediately, without further selection, may be turned to account in thought. By the second law, in so far as it alone controls, the memory furnishes, on the contrary, only material that is not immediately usable in thought. How important this difference is in the work of teaching will be more fully discussed in the following chapter.

Reversing the question, we may now ask, How does thought re-enforce memory?

The narrow worshippers of memory may well wonder at this question, particularly since many of them think that the early training of thought is a hindrance to memory. We shall have to leave them in their wonderment for the present; but since, as Plato says, wonder is the mother of philosophy, this astonishment may have the good result of teaching one to think more favorably of thought—even from the standpoint of the narrow partisan of memory. The foregoing question is answered by the important fact above established. If the law of thought is also one of the two laws of memory, it follows that the *work of thinking must at the same time accomplish a considerable part of the work of memory*. This volunteer service of thought to memory may be of twofold character. On the one hand, wherever thought takes place, its help to the memory is spontaneous and unsolicited; on the other hand, in instruction it may be employed intentionally as a means of memory. This point will likewise receive further consideration in the following chapter.

At the close of some of the foregoing sections we have taken advantage of the opportunity offered to clear up our

ideas of certain psychological phenomena, which, though not belonging strictly to our theme, stand in close relation to it. In this way have been treated the sensations, the rise of perceptions out of sensations, and of complex ideas out of simple ones. The present seems to be the proper place for some remarks on the phantasy, or imagination. For, since the imagination has something in common with memory on the one hand, and with thought on the other hand, opportunity is here afforded to define more sharply the meaning of memory and of thought in this respect.

We first may ask wherein the peculiarity of imagination consists. New sense ideas are not furnished by the imagination, but only by the senses; nor does it furnish new abstract ideas, for this is the work of the understanding alone. The imagination, therefore, operates with the store of ideas already at hand, and is, hence, nothing but a peculiar kind of reproduction of ideas. In ordinary recollection, the ideas come back into consciousness in just the form in which they were originally apprehended; in the case of imagination, on the contrary, the ideas are rearranged, wherefore we may speak of the activity of imagination as a modified reproduction. But now, since the simple or elementary ideas are in their nature unchangeable, it follows that this modification and rearrangement can relate only to the composition and sequence of the complex ideas. This modification of a complex idea may take place in three ways. This is as true of the intentional as of the unintentional use of the imagination; but, as the reader knows, we always have uppermost in mind the involuntary and spontaneous processes.

The first modification consists in leaving out single elements in the reproduced group of ideas,—as when, for

instance, anyone tries to recall the face of an absent acquaintance, but finds that he does not succeed completely, because single features have dropped out of his memory. This is plainly only an instance of inexact, unfaithful recollection. Nevertheless, it may happen that a complex idea so changed will thus receive a character noticeably different from the original, and therefore produce a different effect. For, if in such a case the lost elements happen not to be beautiful, the remainder will appear more beautiful, and therefore this modification will be in its effect what we call *idealization*. Take an example from every-day experience. If one imagines one's self in a situation long since passed, for instance in one's childhood, that period, with its events, conditions, and persons, as a rule, will appear to him in a more beautiful light than it did at the time when he actually lived through it. The ideas of the manifold disagreeable inconveniences, which were not wanting in that early time, are now partly forgotten; moreover, the feelings connected with those ideas which are not forgotten, have weakened more or less; since a pain, after it is overcome, no longer hurts as it did when it was actually felt. Now, this must naturally result in the remaining features of this picture assuming a more friendly character. Thus the recollection has been involuntarily and unwittingly idealized. On the contrary, distrust, envy, hate, in short, all sorts of ill-nature may so work upon the recollection that, in the picture left in memory of the events, conditions, and persons in question, the gentler and kindlier features disappear, thus resulting in a disfigurement of memory, the exact opposite of idealization. What we have been considering in all these cases is, as the reader sees, in its genesis and its nature, nothing

more than an *inexact recollection*; but still, in order to indicate that this change has given a noticeably different character to the ideas, such modifying reproduction is said to be imaginative. The justification for this particular name is more plainly to be seen, when one remembers that this modification may also take place purposely. This first mode of the modifying reproduction, in which the change consists in the omission of certain elements, is called the *selecting imagination*.¹

Secondly, the work of imagination may consist in adding new elements to the complex idea, thus reversing the foregoing mode. It is an instance of intentional imagination of this kind, when, for instance, an artist, in order to represent an angel, imagines wings on the human form. But, even in daily experience, we find it occurs unintentionally likewise. Thus, for instance, when anyone hears or reads an account of an event and wants to get a very clear picture of the occurrence, he will picture it to himself, *with all details*. For, since language uses only general terms, the hearer must make these more or less *concrete* by filling out the further characteristics, — thus, for example, he must think of the persons mentioned as of a definite stature and size, in a particular dress, circumstances, etc. Because the reproduced idea is here further filled out and thereby more exactly determined, this second kind is called the *determining imagination*.

¹ This process of abstraction in the field of phantasy must not be confused with that which takes place in the process of thinking. In the first case, the abstraction takes place on a single complex idea; in the second case, on the contrary, after a comparison of at least two. If, in the former, the given complex idea was concrete, the result of abstraction remains likewise a concrete idea; in the latter, on the other hand, the result is always an abstract idea or concept.

Only seldom will this second kind of modified reproduction occur alone; both modes are usually united, particularly when the imagination has much play — for example, involuntarily in dreams, or voluntarily in art productions. This is, then, the third kind, and is called the *combining imagination*.

The phantasy is usually thought of as completely free and unbound by law. If this is not a complete error, one must at least define the word freedom and explain in how far the phantasy is unbound, that is, in what respect it is free, and furthermore in what respects it never can be free. The involuntary imagination is free in no respect, but is bound just as much by natural laws as are the processes of physical nature. First, it is bound by the store of ideas already at hand, as a general preliminary condition; for a man blind from birth cannot imagine color, nor a deaf man imagine sound. Secondly, being a reproduction, it is bound by the two laws of reproduction of ideas (simultaneity and similarity); for there is no third way in which one idea can recall another into consciousness. Thirdly, it depends on how the older ideas were gained, on the relation in which they stand to one another, and in general on their ease of reproduction; for whatever here is well or badly done or left undone is sure to show itself in the reproduction, either as retentiveness or forgetfulness. These are the rules by which the phantasy is bound. The apparent lawlessness of its productions is only seemingly so. However singular, for example, the images of a dream may look, and however singularly they may succeed each other, they have, nevertheless, come into consciousness exactly as under the circumstances they had to come.

The voluntary imagination is likewise bound by the

above named three kinds of conditions. But, since the will comes in as a new factor here, the imagination receives thereby a freer scope in two respects. In the first place the will, according to its purpose, may direct the mind from step to step in a definite direction, or to a particular point,—all the time, however, dependent on those three conditions as to what ideas come into consciousness. Secondly, the will may now select and retain, according to its purpose, certain ones of those ideas which were actually called up. There is no freedom for the imagination in any other sense. An important rule for the cultivation of the imagination follows from what has just been said. We must above all direct our attention to that on which the imagination as a species of reproduction naturally depends. In other words, *the greater the power of reproduction of the ideas* the better. But the same advice applies to the cultivation of the intelligence in general, as we shall see in the following chapter.

In its genesis, therefore, the imagination is to be distinguished from the memory, since each is a species of reproduction. On the other hand, it must not be confounded with the understanding, although both produce new ideas.

The imagination has still many other interesting aspects. It is of great importance not only in artistic creation, but no less in the discoveries and inventions of science, and, besides, in many practical walks in life, for example, for the soldier, the judge, the teacher, etc. From all of which it follows that in the school its cultivation must not be neglected. But to discuss all of this would require a separate monograph.

CHAPTER IV.

APPLICATION TO PEDAGOGY.

It remains to apply in pedagogical practice the entire results of our foregoing psychological investigation.

Since this practical consideration appears in a psychological monograph only as a sort of appendix, it will naturally have to be restricted in many ways. In the first place, it will be restricted to the intellect only; for if the feelings and the character were likewise to be considered, this would have had to be preceded by a psychological investigation into the activities of feeling and will. Beside this limitation of *aim*, there, is then, a second in respect of the two *means* to be employed, thought and memory; for their conjunction here means, that the one as well as the other activity is to be discussed only in so far as is necessary to make plain how they can and should work *together* in the building up of knowledge. Inside of this narrow field we must, moreover, be satisfied with but a few instructive examples from one or another of the subjects of study.

To commit to memory means to make the ideas in question capable of reproduction and, as far as possible, of faithful, rapid, and many-sided reproduction. It is to be noticed here that the purpose of committing to memory is not stated to be the *retention* of ideas, but rather the *power of reproducing them*; for whether they are retained or not will show itself in whether they can be reproduced or not. Ideas incapable of reproduction have no more mean

ing than dead capital or possessions in the moon; and, as long as they remain incapable of reproduction, so long are they — together with the pains spent in learning and committing to memory — lost to the mind.¹

If, now, thought results in a production of new ideas, and memory embraces the whole of the previously acquired ideas, thought and memory in their service to knowledge bear the same relation to each other as do earning and saving in daily life to the acquirement of a competency.

In school instruction, therefore, both activities necessarily belong together, — as necessarily as in domestic life industry and economy, or, as in walking, one leg and the other, or, as in politics, the progressive and conservative parties. And if they *belong* together, they must also *hold* together, as faithfully and inviolably as in the home and family man and wife do.

First of all, we must find the places where the memory must render assistance to thought and to the learning of new ideas in general. For this purpose we must recall to mind the different stages or steps in the acquirement of new ideas.

All knowledge in any subject must begin with the apprehension of concrete material, or, as we usually say, with *observation* (I.).

With the perceptions so acquired as a basis, the second step in learning follows, namely, the production of abstract ideas or conception, in short, *thought* (II.).

¹ If the reader thinks this is too strong language, he may console himself with the story of the cabin-boy, who came to the captain one day and said piteously : " Sir, is a thing lost when you know where it is ? " " You crazy fellow," cried the captain, " why, how can it then be lost ? " " I am glad to hear you say that," replied the boy ; " I have just dropped your silver mug into the sea, while rinsing it."

But in school instruction this cannot be regarded as the completion of the act of learning. In several different ways one is led to conclude that there must be a third part to the process. In the first place, the newly produced concept is, as a rule, still incomplete—in its *extent* as well as in its *content*. In its extent, because it has resulted from but a few, perhaps only two, observed examples, and therefore embraces but very few concrete ideas; in its content, because the characteristics of which it consists are seldom so sharply and distinctly apprehended as they ought to be. In the second place a concept developed from but few examples increases only the ability to *know*, not the ability to *do*; that is to say, since this thought-process has taken place but once, it has not yet acquired readiness and skill in practice. And thirdly, outside of those ideas from which the concept was acquired, there may be still others in the mind belonging to this concept. If, now, the process of conception stops short with those few examples, then all the rest of the related perceptions have lost the advantage of their association; they remain as nothing more than raw material of intelligence, not yet having been changed into higher products of knowledge to become instruments of thought, or organs of apperception, as our friends the Herbartians would say. This shows us that intelligence resulting only from the above named two activities (observation and thought as a single act unrepeated), would be faulty in many ways, and therefore something must be done to supply this lack. This third and concluding part of the process consists in the *application* of the acquired concept (III.).

In school instruction this third step will usually consist in presenting to the pupil a number of new concrete exam-

*ples one after the other, for him to see whether they likewise belong under the new concept. What takes place in the mind of the pupil in this case is, in the main, evidently nothing else than the repeated production of the same concept. We are, nevertheless, justified in giving this mental process a special name. For, in the first place, new material is now used in the process. And secondly, the pupil must now proceed with the work of *thinking independently of the teacher*; besides, the task may be still further increased by requiring the pupil himself to hunt for new examples. Thirdly, thought proceeded the first time from the percepts to the concepts; now the concept is ready to be applied to new perceptions. Therefore the difference between the first act of conception and this act of application is usually denoted by saying that in the former, the movement of thought is from the *particular to the general*; in the latter, on the contrary, from the *general to the particular*. A well-known instance of such application is furnished by the examples in arithmetic, which are to be worked by the pupil independently.

All true intelligence — that is, all information, that has at the same time become organized knowledge, and therefore able to develop power — requires the united action of those three productive activities of learning: *observing, thinking, and applying*. If anything is left undone in one of these respects, the loss cannot be made good again. What is thus true on the whole and in all branches of knowledge, is also true of every single topic, every “method-unit,” i.e., every portion of concrete material from which one general notion or concept is to be developed. Every such topic must be worked over in this threefold manner — by observation, by thought, by application.

These are the three chief acts or formal steps in the process of acquiring knowledge.¹

We have now to inquire what part the memory should play in connection with these three acts. It was already shown that the learning of new ideas and their commitment to memory should go hand in hand. It follows from this that, in a lesson, every productive operation of the mind should be followed by committing the result to memory. Thus the results of observation (I.) must be at once impressed on the memory; the result of the thought-process (II.) must be immediately committed to memory. Only in the third step may special attention to memory be omitted, because in the process of application the act of thought is repeated on and on, and therefore of itself accomplishes the work of memory. The place, therefore, of the omitted memory-drill may be taken, if one wishes, by final reproduction of the whole lesson as a test — either orally or in writing, and in the latter case perhaps in the form of an independent essay.

The question may now be asked, Why, then, must the

¹ In the second of these steps we may, as before shown, distinguish two acts, judgment and conception. Furthermore, the first step requires a preliminary act, to connect the new knowledge with the related old, thus resulting in two sub-acts here likewise, the introductory preparation and the presentation of the new matter. Hence, if we count these four sub-acts in place of those two chief ones, we shall have five formal steps. Conf. Rein, *Outlines of Pedagogics*, trans. by Van Liew, p. 145. It is taken for granted that the reader has the good sense to see the limitations and countless modifications of these steps in practical school work. They are but a *resumé* or generalization of exercises used and recommended by all good teachers for centuries, and are in no way intended to restrict or fetter the freest activity of the pupil. To discuss all of these points would, however, require too much of a digression here. It is hoped that a special monograph on this subject will soon be published, treating of the psychology of the recitation.

operations of learning and committing to memory go strictly parallel with each other? — or, in other words, Why may not the intentional commitment to memory be postponed until all three acts of learning are ended? The answer is very simple. If the concrete perceptions are not impressed on the mind and made easy of recall, the *thought-process* will take place *indifferently*, or perhaps not at all; and if the resulting thought product is not likewise stamped on the memory, it will be *hindered* in its *application* to other examples. Another reason still deserves consideration. Everything should be impressed on the memory as soon as possible after it is first learned; for the longer one waits the more one loses of what was learned.¹ Dr. Mager used to say, “*When the repetition is necessary, it comes too late.*”

Another point in regard to how far the observation material should be committed to memory needs some explanation. Since, in any single lesson, in history, for instance, this material is not thoroughly worked over in all its parts, but only some few ethical thoughts are developed from it, perhaps even only a single one, the question arises, Why, then, must the memory nevertheless be burdened with all this concrete material in its details? In answer it may be said, that whatever of the observation material was not used on this occasion may be made use of later in another lesson — either as an example for comparison in the case of the formation of concepts, or as an example for application. If the work is properly planned, this will undoubtedly actually be done with a considerable part of the concrete material remaining over. For, later on, where are

¹ Compare Ebbinghaus's experiments showing curve of forgetting, pp. 125-126 of this book.

the examples for comparison and application to be obtained, if not in the main from the concrete material of the previous lessons? These concrete ideas must, therefore, ever be ready at hand and as easy of access as possible. Whatever is left over after the school years are past may still be turned to account in later life. Facts of observation are, to be sure, only raw material, but, in case they are retained in memory, they may be continually turned to account in ever new uses — just like a tree that bears fruit unceasingly, needing only somebody to pick it off. To allow the observation material to be forgotten would be like cutting down a fruit tree after it has borne one crop.

Having thus determined whereabouts in each lesson the memory is specially to be exercised, it still remains to indicate the sort of exercise.

This is the point that makes our subject of such great practical importance in teaching, because the old psychology has nourished didactical errors in this regard, which are not only among the very worst that there are in the whole field of teaching, but, besides, they have made themselves particularly dangerous by being surrounded with a sort of sacred halo. The foregoing psychological investigation will put us into a position to recognize the right method of committing to memory, and to see the mistakes on the right and on the left in the proper light.

We turn now to the *ways and means* of committing to memory. To avoid going astray, we must keep firmly in mind the above definition of memory. To commit to memory is, namely, to make the acquired ideas as capable as possible of reproduction, and not only that they may be faithfully and quickly reproduced, but also that they may be reached from many sides, i.e., through many different

ideas. In this definition three points are to be noticed. First, that which is here assigned as the purpose of committing to memory, namely, the power to recall the ideas. Hence, everything that has any influence at all in making the ideas capable of recall will come under the head of ways and means of committing to memory. Secondly, it is to be noticed that not only a one-sided, but a many-sided power of recall is demanded. Hence it follows, that if one means of committing to memory results in a *more-sided* power of recollection, it deserves higher estimation than another which secures only one-sided reproduction. Thirdly, mention is here made only of the purpose of committing to memory, and nothing is said about any particular method, or about the kind of ideas remembered. For, since there are different ways of committing to memory, the definition can contain only what is common to them all, and that is merely their purpose. Hence, if any one included in his meaning of memory a particular means of committing to memory, e.g., by repetition, all the other means would remain unused; and if particular kinds of ideas were included, all other kinds would be omitted from the benefits of memory. The above definition will, therefore, serve as a sure guide, and prove its value even at the very beginning of our survey.

Keeping in mind, then, that the reproduction of an idea is the purpose of committing it to memory, we must at once recur to the two main forms of memory, to which all others are subordinate. Corresponding to the two laws of memory (similarity and simultaneity), are the two entirely different ways of committing to memory: the one associates the ideas by their content, and the other associates the ideas by the accidental factor of contiguity in time.

As early as Kant, these two fundamental kinds were distinguished, the first as the judicious¹ or *thinking memory*, and the second as the *mechanical memory*.

The fact that these are the two essential forms, means that every activity of memory, whether intentional or unintentional, takes one or other of these two ways, and associates the ideas in question either thinkingly or mechanically. If, therefore, repetition is made use of intentionally, it is not limited to either particular method of association, for it can take place in one way as well as in the other. Hence it follows that repetition is likewise of two kinds, either thoughtful or mechanical. If we add, further, that the commitment to memory may also take place involuntarily or spontaneously, and that here, likewise, either a thoughtful or else a mechanical association is formed, we shall have before us in full the fundamental forms as well as the secondary forms of the memory.² Thus we see the distinction between the two methods of association extends through the entire field of memory. It will, therefore, be advisable to examine this difference somewhat more closely before we take up the other differences between intentional and unintentional remembering.

What is the relative value of the two methods of asso-

¹ From *judicium*, meaning judgment, deliberation, intuition. Hence this sort of memory is also called the "deliberative," the "reflective," the "rational," or the "logical" memory.

	<i>Fundamental Forms.</i>	<i>Secondary Forms.</i>
² Commitment to memory may be either	Thoughtful (by law of similarity),	{ Intentional, or Spontaneous.
	or Mechanical (by law of simultaneity).	{ Intentional, or Spontaneous.

ciation with respect to the strength of the association, or of the power to recall the idea into consciousness? First and foremost, we must inquire this relative value at the time of the first association, and without regard to any later repetition. The following may serve as concrete examples of the two cases. Of mechanical association: An object and its name, or a fact in history and its date, or a foreign word and one in the mother tongue, or several sounds composing a melody, or several words forming a sentence, etc. Now, on the contrary, in case the association is through thought, the similarity or relation of the ideas must have been recognized before, and hence it must have been preceded by an act of thought, although, perhaps, only a spontaneous process of conception. Suppose, for example, associated in this way, the square and the rectangle through the concept parallelogram, or the pine and the spruce through the concept conifer, or the ascent of a balloon and the fall of any other body through the concept gravity, or two historical events through the fact that one is recognized as the necessary consequence of the other, etc.

Let us now compare the results in the two cases. The value of the association may be measured in three respects: by the *intensity* of its strength, by the *extent* of its influence, and whether the power of recall is *one-sided* or *many-sided*. How much strength there is, or rather let us say, how little strength there is in mechanical association, when the ideas meet in consciousness but once, the reader may attempt to estimate approximately for himself. On the other hand, in the case of association by thought, when two similar ideas are present in the mind, if one comes into consciousness, it may reproduce the other without any previous act of con-

ception having taken place (see page 44). Hence it follows that these ideas, even before the particular act of thought which unites them, are by their very existence as closely bound together as the mechanically associated ideas. Whatever strength the act of thought adds is, therefore, entirely in excess. This superiority in strength is owing to the recognition of the likeness in the two ideas, which is then expressed in the resulting concept. The concept is a band, as it were, or clamp to hold the ideas firmly together. I say a band "as it were," for that which here binds together is not something external, something outside of the ideas, as was the case in mechanical association, but objectively it is nothing but the similar content of the ideas, and therefore belongs to their very nature; subjectively, it is nothing but the recognition, the becoming conscious of this content. Hence it follows that this association by thought lasts just so long as the concept lasts, and the concept lasts so long as the ideas as such exist at all, that is, so long as their content is not lost. In a word, in case the concrete ideas are clearly apprehended and their similarity distinctly recognized, the association is so strong that it cannot be any stronger, and hence no repetition would be necessary to strengthen it; for, if one did undertake to repeat, this would only be for the purpose of making the contents of the concrete ideas wherein the concept is included, plainer and thereby stronger. The strengthening of the association results then of itself. Association by thought, therefore, possesses already in its very nature as much strength intensively as the mechanical association can reach even *after many repetitions*. But still further. In the act of thought the concrete ideas together with the concept have been *simultaneously* in consciousness. Hence

it follows that they have likewise been associated mechanically, and therefore in this point are once more as strong as ideas associated by simultaneity alone. In comparison with the exceeding strength which the thoughtful association already possesses in itself, this small addition of a single mechanical association need hardly be counted; we have mentioned it only in order to show clearly and with completeness the great difference between the two associations. The excess, as one sees, on the side of thoughtful association is truly enormous.

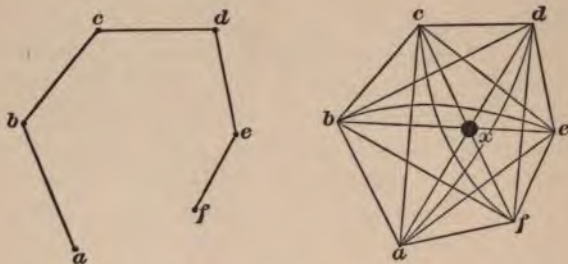
Turning our attention now to the *extent* of the association with respect to other ideas, we see that in mechanical association without repetition the power of reproduction, as a rule, does not extend beyond a sequence of three or four ideas; to gain command of a greater number requires several repetitions. On the other hand, the thought association embraces, to begin with, as many concrete ideas together with their concept, as have been compared in thought; it may have been two, three, four, or more. But the reproductive power extends still further. For, after the concept has once arisen, its light and power extend to all the other related ideas present in the mind; they also become, according to the degree of their relationship, more ready of reproduction, and belong accordingly to the sphere of recollection in the centre of which the concept lies. It is easy to see that this is the case from the fact, for example, that the pupils, after the concept has been formed, are able to hunt new examples for themselves. The power of the concept will affect even those related ideas which do not come into the mind till later; as soon as these are born, they likewise belong at once to this sphere of reproduction, and therefore share its strength. In this case thought has

performed the work of memory in advance, as it were. It is plain to see that the thinking memory has a far greater extent of influence than the mechanical.

Lastly we inquire into the direction in which the power of recollection is exerted, whether it is, namely, *one-sided* or *many-sided*. In the mechanical association there are always only two members in each case so strongly united, that they can mutually reproduce each other, and even with these few the reproduction backward is not as easy as forward. If the series extends beyond two or three members, then only a one-sided reproduction is possible, namely, forward. In the sphere of ideas associated by thought, however extended it may be, the connections of memory are, on the contrary, many-sided, or rather all-sided. For, in the first place, the whole of the concrete ideas belonging together can reproduce one another mutually; and, secondly, these ideas and their concept are likewise mutually associated.¹ In a word, in this region the roads for the commerce of ideas are laid out from the centre to all points in the boundary, and again, all the points in the boundary are connected with each other, — in brief, every idea can reach any other idea. Suppose we represent these connections between the ideas by connecting lines in a diagram. In the first figure on the following page, *a, b, c, d, e, f*, symbolize six ideas associated mechanically in a series. In the second figure are six ideas similarly symbolized, but associated by the many-sidedness of thought. They are held in the grip of the concept *x*, and by the similarity of their content any one is capable of reproducing any other one. The relative number of connecting paths in the two figures

¹ A concrete idea can, moreover, call up its concept more easily than *vice versâ*; the reason for this the reader may hunt for himself.

will serve as a basis of comparing the availability of ideas associated by the two methods.



The result of the foregoing comparison may be briefly summed up as follows: the power of the thinking memory is —

1. *Intensively much stronger* than the mechanical memory,
2. *Extensively greater*, and
3. In direction *all-sided*, whereas the mechanical memory reproduces in series only, and is, in case there are more than two or three members in the series, only one-sided.¹

We return now to the distinction between intentional and involuntary, or spontaneous memorizing (p. 97).

In the very process of learning new ideas they are spontaneously impressed on the memory. This takes place, as we shall see, in all the three steps in learning new ideas.

¹ Further on we shall note still other weak points in the mechanical memory, such, namely, as show themselves when the memory seeks help by repetition. The influence of the emotions may, to be sure, upset any such calculations as that in the text; and yet I think the feelings too will usually be found strongest in association with thought rather than with mechanical reproduction. The present monograph, however, concerns itself with the intellect only, and therefore may make the facts appear simpler than they really are.

(I.) *Observation* has for its purpose the apprehension of concrete ideas. Now, in so far as these ideas succeed each other in series, each two, and therefore also the whole series, become united by mechanical association. But also so far as there are ideas in the series that are related with one another, or with earlier ideas, in so far do we find also the precondition for the association by thought. The working of mechanical memory is here plain to see; the other kind is, on the contrary, hidden, because it appears only in the form of the precondition. Thus the activity of observation performs in and with its own proper task of acquiring new perceptions, likewise a portion of the work of memory in both its forms. Now, one might think that, although this was right in theory, yet this first beginning could probably have but little importance, since the mechanical association takes place only once, and therefore is very weak, and the association by thought occurs only in the form of the precondition. But that would be a great mistake—just as great as if one thought that education could not and should not begin until the pupil is already quite grown up. What is true of education in general, is also true of memory: it is just this first committing to memory in and with the work of observation that is of predominant importance. To understand this, it is only necessary for one to consider why *observation* is of so great consequence for the succeeding work of (II.) thought and (III.) application. For the success of these two processes of thought-elaboration depends essentially on the way in which the concrete ideas were originally formed: whether they were vivid, strong, and distinct, or, on the contrary, faint, weak, and obscure. And this again depends on whether they were apprehended with interest, and hence

also with attention, or, on the other hand, indifferently, and therefore inattentively. To enumerate all that goes to arouse a lively interest in the work of observation, and, with its help, to secure further a vivid, strong, and distinct apprehension, would exceed the limits of this book. One point only will I call attention to, and that is the great difference it makes, whether, for example, in history, the matter is presented in general outlines, as in a compendium, and hence not concretely, or, on the contrary, is given with full and complete detail, and hence concretely and vividly. Just in proportion as the concrete ideas are originally strongly and distinctly apprehended, so are they also strongly and distinctly retained and firmly associated. Hence it follows, that whatever value the work of observation has for the succeeding processes of thought, exactly the same value attaches to the spontaneous memorizing of it for its reproduction in these later processes. A discussion of memory which underestimated the importance of this unintentional memorizing in the work of observation, would therefore betray as gross ignorance as a discussion of the process of learning in which the importance of the work of observation for the succeeding elaboration in thought failed to be recognized. The success of the work of observation depends, however, as we have seen, on the choice of the right method of teaching.

To this right method in the work of observation belongs, however, one other point which was only incidentally mentioned above in speaking of the formal steps. In the work of observation, namely, the presentation of new matter must be preceded by a preliminary act, the so-called *preparation* (or introduction, or "analysis" as Herbart says), in order that the new may be associated with the old. I want

to point out the connection between this preliminary act and the memorizing of the new ideas. In two respects it helps to strengthen the association. First, by awakening a more lively interest for the new matter. The preparatory step seeks, namely, to recall to mind related ideas from the child's personal experience in and about his home. Now, since the child has more interest in what he has himself experienced than in what he otherwise learns at school, the new ideas associated with these experiences gain likewise a more lively interest. How this increase of interest helps the memory was already shown before. The second way in which the memory is strengthened is as follows. The scenes of one's childhood and early experience, on account of their frequent repetition and their close connection with the feelings, are the best remembered. Ideas connected with these are therefore the most lasting that the mind can have. Just think, for example, of homesickness, or call to mind how, in advanced age, when the memory begins to weaken, youthful reminiscences still remain vivid as ever. If the new ideas are associated with such strong old ideas, the former will thereby gain a powerful support, — just as when a weak young sapling is tied to a stout pole firmly planted. It is, moreover, not to be overlooked that this association, being with related ideas, takes place through thought, and is on this account also already very strong.

In how far the (II.) *thought-process* in and with every conception at the same time performs the work of memory has already been fully explained in connection with the comparison of the thinking and the mechanical associations. Hence, the more thoroughly the concrete matter is elaborated in thought, the more abundant and many-sided

will be the assistance it will gain in reproduction. Since the association by thought is so strong, the act of conception has but slight need of repetition. The need occurs in greater degree only when the result of thought is expressed in a rule, maxim, sentence, proverb, or verse, which is therefore to be learned word for word and hence must be memorized mechanically.

In the work of (III.) *application*, the process of memorizing is apparent, for with every new example for application the process of conception is repeated. What would otherwise have to take place by intentional repetition in order to make the concept distinct and ready of use, takes place of itself now in and with the application to the new cases. Hence, we find here spontaneous memorizing in the form of repetition, but not of the mechanical kind.

Thus we see that the process of learning serves of itself to impress its acquisitions on the mind. This is true of all its three main steps, in the first of which the service is partly by the law of similarity, and partly by the law of simultaneity, but in the last two stages it is exclusively by the law of similarity of ideas. Such a memorizing, not undertaken for its own sake nor purposely, but being carried out along with the process of learning, is called *immanent*, because inherent in the latter process. Since it, therefore, costs neither time nor pains, it is plain that it has a much higher worth than voluntary memorizing. Hence we may say: the more the course of study and the method of teaching are so planned as to allow of the greatest possible amount of immanent memorizing, the more complete will they be. For, the more an unintentional memorizing finds place, the less time will be required for an intentional one, thus leaving more time free

to learn new things. Thus the amount of immanent memorizing furnishes an excellent means of testing whether the correct method of teaching is followed.

Two subjects in the course of study are particularly adapted to furnish such opportunities in the form of examples for practice. These two are, namely, arithmetic and language, particularly foreign languages; but drawing may well be counted with them if it is rightly taught. Thus, for example, in the instruction in foreign languages the double translation is a continual repetition by application of what was thus far learned from grammar and lexicon. The same is true of the exercises for application in arithmetic and drawing. Why it is that in these subjects this kind of immanent memorizing has so much room, is not difficult to find. Leaving out of account whatever is peculiarly favorable in each of these subjects, and also aside from the fact that the practical purpose of all of these subjects is a ready ability *to do* or, more exactly, *to apply* what is learned, the remaining reason is that here the exercises for application can easily be arranged as silent or busy work, namely, so that the teacher does not have to be continually at hand to help. We may infer from this what would have to be done in order for the other subjects of instruction likewise to gain as far as possible the advantages of immanent memorizing. The exercises for application would have to be as extended as practicable and as far as possible in the form of silent busy-work. Moreover, immanent memorizing may be favored by a correct arrangement of the course of study, namely, by the correlative association of the various subjects in the curriculum.¹

¹ A good example of this is furnished in Wilbur S. Jackman's *Number Work in Nature Study*.

Intentional or voluntary memorizing makes help of *repetition*. What is the nature of this means, and how does it help in making the ideas easy to recall? Has it only to do with the mechanical memory? And what is its effect? In no text-book of pedagogy will the reader probably be able to find an exact discussion of these questions, and particularly of the first in regard to the exact meaning of repetition, nor will the psychologies probably contain any reference to them either. Everywhere such a discussion seems to be regarded as superfluous. Ah, if there were only innate ideas! But it is often just the simplest, most elementary relations that are the latest to be completely apprehended, because every one mistakenly thinks he has already mastered them. As a matter of fact, the usual ideas in regard to these questions are in many respects obscure and faulty, and Voltaire's expression: *Le superflu — chose si nécessaire* is nowheres more applicable than here. We shall, therefore, at once take up this apparently superfluous and yet so necessary task, and seek first of all to define repetition; the rest will then follow of itself.¹

Of course every one knows what the word "repeat" in general means, namely, to do anything over again. But

¹ How very lacking many of the text-books in pedagogy, even those officially recognized as such, are in many matters needing most necessary explanation, is all the more apparent, when we remember in contrast how much they contain that is superfluous. It is usual, for example, to enumerate a long list of so-called methods of teaching, of course under some strange tongue-twisting name ("acroamatic," etc.), all of which is but vain and useless waste of words and pedantic cling-clang, whereas the indispensably necessary chief divisions of the teaching process, the three *resp.* five formal steps, are not even mentioned. And then, as a result, pedagogy must submit to official scorn on account of its "Elusinian mysteries"!

what is its special meaning here, in the field of psychological pedagogy? Here we have to limit the meaning by telling what it is that is done over again. Perhaps, then, some one will say: To repeat means to call back once more into consciousness acquired ideas. This definition is, however, too narrow; for there are not only ideas to be repeated, but also feelings, acts of will, etc. But even in the field of intellect, that definition would be insufficient, because it is obscure in one point. A couple of examples will show what I mean. When a concept is to be repeated, the teacher may, perhaps, give its definition again, or, it may be, only the name of the concept. This will evidently call the ideas in question back into consciousness; but is the effect the same as if the *original process of conception were once more performed*? And if ideas of sense are to be repeated, is it the same, whether they are simply recalled into consciousness from memory, or whether they are again produced by *observation*?¹ There are, as one sees, two forms of repetition, the one stricter and more complete, the other less effective; one carries out again the original act of production of the ideas in question and their association, the other, on the contrary, brings up only the more or less faded result of this act. Of course it is neither necessary nor, as a matter of time, practicable to undertake repetition exclusively, or even mostly, in that stricter form; but it is necessary that the teacher should know that there are two forms, so that he will not be applying the incomplete form where of right the better

¹ This difference shows still more plainly in an example taken from the feelings. Suppose an emotion is to be repeated; does it amount to the same thing whether the actual *emotion* is again called forth, or only its name, and hence only the *mental idea* of this emotion?

one should be used. When repeating for the first time, particularly in the lower and middle grades, he will certainly have to recur, as a rule, to the original process. Thus, for example, a history lesson will not be reviewed the first time from memory only, but will be presented again in class, or read in the text-book. Repetition in the stricter form is, consequently, nothing else than once more going through the given operation of learning (the work of observation, or that of thinking). To sum up in one definition, we may say: To repeat means (in the field of intellect) to call again into consciousness the ideas in question — either *productively* or *reproductively*.

The relation of repetition to the two natural forms of memorizing, the thinking and the mechanical, may be easily stated. It is a means of help, offering its assistance wherever needed, to the thinking association as well as to the mechanical. Wherever its service is accepted, it assumes the same character as the particular form of memorizing, just as a servant wears the livery of his master. In the one case the repetition is called thoughtful, in the other mechanical, although in itself it is entirely neutral in this respect. Hence when, as often happens, the word repetition is limited in meaning to mechanical memorizing, this is simply an error, showing that the relation between repetition and memorizing has not been made clear in such case. Repetition is a *means*, memorizing is its *purpose*, and the final purpose of memorizing is the *reproduction* of the ideas.

So far as the effect of repetition on the memory is concerned, the following is to be noticed. That which is strengthened is, in the first place, each of the ideas in themselves; and, secondly, their connection, no matter

whether this connection is in thought or only mechanical. In the case of mechanical repetition it is, however, not to be overlooked that the resulting strengthening of the ideas makes them more capable, likewise, for reproduction in thought, in case opportunity offers later. The amount of help afforded by repetition may also be pretty accurately expressed, at least in the case of the completer form of repetition. If the mental process of repetition is not different from the original act of learning, the aid to memory is essentially just as great in the one case as in the other, no matter whether it is a thinking or a mechanical association. I say "essentially" just as great; for there is, to be sure, a slight weakening, owing to the absence of the stimulus of novelty. Of course, too, this weakening will increase with every successive repetition. How much is to be deducted in case the repetition takes place in the shorter form of simply recalling the result of the previous act, the reader may estimate for himself. This question deserves particular attention in the case of historical subjects. If the stricter form of review has already accomplished its purpose, or if, from any cause, it may be assumed that the ideas are, for the present, sufficiently secure, then the reproductive form possesses certain advantages over the other. For, in the first place, the self-activity of the pupils will be called into play more strongly now; secondly, the change of form affords a new stimulus; and finally, in case the review takes place by questions, there may be even a third advantage, of which we shall speak later on, but which the reader will have no difficulty in already guessing. It all depends, as one sees, on using the two forms of repetition each in its right place; and in deciding which is the right form, one must consider also the nature of the subject-matter to be reviewed.

In regard to the practical treatment of reviews, one point deserves special mention on account of its weight and general importance. Nothing prevents making an easy, quick, and lasting impression on the memory more than to offer it too much at once. Professor Ebbinghaus found he could remember seven nonsense syllables after a single reading. It took, however, sixteen readings to remember twelve syllables, thirty readings to remember sixteen, forty-four readings to remember twenty-four, and fifty-five readings to remember thirty-six syllables. The psychological reason for this is closely connected with the so-called limit of consciousness. This fact leads to the familiar rule, if a series of ideas to be committed to memory is too long, to divide them into smaller portions or groups and then memorize the groups, thus building up the whole series gradually. This is what Ratich expressed three hundred years ago, when he said everything must be learned "*piecely*." This rule of practice applies to both kinds of memorizing, but in particular, of course, to the mechanical. The reason for this is easy to see. For, the mechanical association is of itself very weak extensively; and besides, its full force extends to only two successive ideas at a time, so that the connection beyond the third or fourth member of the series can only be very small. Accordingly we divide a story, for example, into smaller sections; a list of names to be learned in order, into small groups (e.g., the kings of England we divide by their families into Normans, Plantagenets, Yorkists, Lancastrians, Tudors, etc.); a stanza in a song or melody is memorized line by line, etc.

In our previous comparison of the strength of association by similarity, with that of association by simultaneity, we

found that the former possesses important advantages over the latter: its strength is intensively much stronger, extensively greater, and besides, many-sided. The comparison, however, took no account of the help to be gained by repetition. Now that we have discussed this means of help as to its nature, its forms, and its usefulness, we shall have to ask, how it stands with the relative strength of those two methods of association, after repetition has taken place.

So far as the three advantages possessed by the thinking association are concerned, it is evident that they remain as before, — of course, provided, that repetition takes place in equal measure in both cases. How would it be possible for the mechanical association to gain anything in its favor beyond the other, since the additional factor on both sides is one and the same? If the two terms of a ratio be multiplied by the same number, the products will, of course, be in the same ratio. The relative situation is, therefore, as clear and definite as an example in arithmetic.

One of the three advantages possessed by the thinking memory, namely, its intensive strength, receives, moreover, new light in this connection that deserves mention. In the previous comparison the fact was already alluded to, that, in every case of association in thought, there was likewise an inherent or immanent mechanical association. Before, we did not care to take account of this comparatively small additional factor. But this addition is multiplied by repetition until it now deserves to be counted; for, by equal repetition in both cases, it already alone amounts to exactly as much as the entire strength in the case of mere mechanical association. The association by thought equals its rival already, therefore, merely by its immanent mechan-

ical strength, so that all its own peculiar power and natural strength are altogether in excess. This comparison, however, the reader must remember, relates to only one of the three advantages, the intensive strength of the association. Both the other advantages—greater extent and many-sidedness—remain forever denied to the mechanical memory, even after the most diligent repetition.¹

From this comparison several practical inferences may be drawn in regard to the use of reviews. The first is, that, in the case of thoughtful memorizing, but little repetition is needed to secure the result desired, namely, certainty and facility in reproduction. The second is, that, in mechanical memorizing very much repetition is necessary, to reach the same result.

This diligent repetition, which in the case of mechanical association is necessary in order to gain any result at all, has furthermore connected with it several noticeable effects,—such as, though not intended, follow of themselves. One is of an advantageous kind; the rest are unwelcome disadvantages, but which, willingly or unwillingly, must be taken in the bargain.

The advantageous result consists in the acquirement of a high degree of facility in reproduction—a facility which may even exceed the proverbial monkey-like or parrot-like

¹ This fact will also explain the origin of the mistaken notion above referred to, of supposing that repetition must necessarily mean *mechanical* memorizing. Since in mechanical memorizing, as a matter of fact, repetition is the more necessary, and it therefore occurs more frequently in the mechanical form, many persons have allowed this appearance to deceive them into forgetting that repetition must and does take place in the thoughtful association likewise. This has also led them to overlook the fact that the mechanical factor does not lie in the repetition as such, but in the mechanical *association*.

rapidity, and which is, therefore, rightly or wrongly, called *machine-like*. One need only recall, for instance, the quickness with which, in speaking a piece, the word-ideas succeed one another, or in singing a melody the sound-ideas, etc., in which cases, however, the trains of ideas could pass much faster still, if the bodily organs concerned in their production could keep up with them. It would, however, be wrong to think that this facility is favored by the nature of this particular manner of association, so as to merit the name mechanical.¹ Because, the reason of the facility lies rather in the act of repetition alone, or more exactly in diligent repetition. Even the thinking association may reach a machine-like facility, if desired, by sufficient repetition. This result may here be reached even more easily, because the association by thought possesses in itself a far greater intensive power than the mechanical, and hence needs a much smaller measure of repetition to produce the same effect. Ordinarily, however, one limits the association by thought to only so much repetition as is necessary to gain complete certainty in reproduction. Whether this is well, whether one should not rather aim at complete dexterity in both cases, the reader must decide for himself. Hence we see, machine-like facility of reproduction is not a peculiarity of the mechanical memory, but is only accidentally more prominent there, since in the other case repetition is somewhat neglected, whereas in the former we *dare* not omit it, if the needful certainty of reproduction is to be reached.

Now let us consider the disadvantageous effects which

¹ The expression "mechanical" here means only that the association is determined by an external, accidental, subjective factor (simultaneity), and not by the internal meaning of the ideas.

the mechanical repetition, when it is diligently practised, brings with it.

1. The first disadvantage consists of a considerable amount of tediousness, resulting from two sources. The first lies in the act of repetition as such, as soon as the stimulus of novelty is lost. That which in its origin seemed to begin only as a lack of enlivening stimulus, soon makes itself felt as a positive depression, or actual tedium, on account of the continued repetition demanded by the mechanical association. In so far as tedium results from this first source, it must affect likewise the repetition of logical associations as well. The other source lies in the nature of the mechanical association, determined as it is by an external and accidental quality which is, therefore, devoid of interest. With this second source of tedium, logical associations have fortunately nothing to do. Now, counting the effects of both sources together, and remembering that the result is not merely the sum but approximately the product of these factors, it will be clear that mechanical repetition must suffer strongly from tediousness, and all the more so, the more diligently it is practised.

2. The second evil is not of a general nature, but occurs only in the repetition of language work, and here only in case the passage is to be memorized word for word, and is of considerable length. As soon, namely, as a machine-like facility is reached in the reproduction of the words the separate thoughts in this complex become thereby *less mobile* for further use in thinking. This is entirely as we should expect. For, since the words are confined to a definite sequence, and the thoughts are bound to the language forms, the latter likewise share in the confinement of the former. Thus, then, the whole is, in the end, securely

memorized, and can also be reproduced easily in the given sequence, but just as the separate sentences stand wedged in in this series, so are likewise the separate thoughts. If one of the middle members of the series is wanted, all the preceding members have to pass in review first. Thus, a certain friend of mine, although able to repeat a speech or sermon on hearing it once, is nevertheless unable to pick out a thought in the middle of the sermon, without beginning at the start and repeating down to the part wanted. The same is true of most of us, when we have committed a poem to memory and wish to quote a particular verse. In the case of a short sentence expressing only a single thought, literal memorizing may not in any way injure the further utilization of that thought in any other connection; on the contrary, its definite expression in language and the facility in the use of such expression render the thought all the more handy and serviceable. The fact that, in learning long selections by heart, the thought becomes stiff and dull, particularly when the selection is of an abstract nature, every one will recognize in his own experience. But the teacher meets it only too often in the class-room, and especially in the still worse form, where already such a selection has been previously learned by heart merely as so many words, leaving the thoughtful understanding of it to follow later.

3. The third evil occurs likewise in the case of verbal memorizing, and, although not a necessary evil, is, however frequent enough in childhood. For, when a child repeats such pieces by heart, he thinks only of the words, but not at all, or very superficially, of their meaning — indeed he may not give his attention to the words even. Thus the most ridiculous blunders may occur, for example, the

craziest (nonsensical or perverted) words may be mixed in, or the speaker, without noticing it, may switch off into another piece of similar sound. A mother reports she overheard the other day, her little girl solemnly and earnestly conning over the following prayer, which she was learning to recite in Sunday-school: "I hardly think I have any father, I hardly think I have any father." After considerable inquiry she found that the dear little soul had mistaken the words for "I heartily thank thee, heavenly Father." In the worst cases of this kind the process has then become almost as mechanical as when any one at his work, or in meditation, hums a tune to himself, without thinking of the separate sounds, or even perhaps being conscious of the act. It is easy to see how this evil result comes about. In the case of language two kinds of ideas must be apperceived, the word-ideas and the ideas of the things. That which is memorized is first of all only the words. Whether their meaning is every time thought of with them is questionable. When the learner spends time and pains on a word or a single sentence, it may be that, as a rule, the meaning is also thought of. But in the way in which children are accustomed to commit to memory, the words usually follow quickly on one another; consciousness is carried along by main force with the train of words. It is, therefore, only too easy each time to think of the contained meaning only fleetingly and superficially. But whenever this takes place it cannot but result in the formation of a habit of irrational and thoughtless repetition. Is it any wonder, then, that this habit later shows its power when the child attempts to speak the piece? Hence, even when the teacher is present, unless he knows of some means to force the pupil to think of the meaning

of words, this evil of thoughtlessness will continue to exist.

So much for the present about mechanical repetition. Further on we shall speak of the means to overcome these evils (see illustrations, pp. 128ff.).

Mechanical association is, as we saw before, far inferior in reproductive power to the thinking or logical association; and mechanical repetition, as we have just seen, results in many evils just in proportion as it is sedulously practised. But are we, on this account, to despise the aid thus afforded to memory? In social science we learn that every workman is worthy of his hire, and that every work that is indispensable in its place, has a really inestimable value, however mechanical and subaltern it may be. Certainly the common soldier cannot perform the work of a field marshal; but woe to the field marshal that has no soldiers behind him! These reflections may likewise be applied to the estimation of the mechanical compared with the rational memory. For the common purpose, the development of the mind, the mechanical memory may in its place indeed render indispensable service, and hence deserves corresponding estimation. When, therefore, fault is found with the mechanical memory, this must be because it has not been put in the *right place*, or has not been correctly employed. Thus it cannot be regarded as a fault if mechanical repetition produces a machine-like facility in reproduction; on the contrary, this facility is a virtue to be highly prized; for the more surely and easily the lower mental activities perform their work, the freer will the higher ones be, and the more can they accomplish in their higher tasks. If, however, this facility has been purchased at the cost of too much pains and distress, and if

the further use of these ideas in thought has been hindered thereby, and thoughtlessness has been cultivated, these are sure signs that Pedagogy has not learned her lesson of Psychology properly. Hence, if mechanical memorizing is to find its proper use, we must first know where its proper place is, i.e., where its service is indispensable; and secondly, how it must be used in order to avoid the evils, and render the best possible service to the higher activities.

We may distinguish three cases in which its service is indispensable. The *first* consists of instances where, in the interest of mental development, ideas must be associated that are not capable of any other than the mechanical, or external, association. This is plainly the chief field of operation for the mechanical memory. Here belong, for example, the association of thing-idea and word-idea, likewise of foreign words with those of one's mother tongue; whence it follows that the learning of a language, important as it is for the mental development, has its foundation in mechanical memorizing. Here belong further the association of thing-idea and number-idea (e.g., in history, in geography, etc.); furthermore, the association of sound-ideas in music, likewise of the sound-ideas with word-ideas in singing; and finally, although it is usually not thought of, the association of the simple ideas (the parts and characteristics of an object) into a complex or composite idea. Thus we see that not even the simple perception of an object can take place without the aid of the mechanical memory.¹ Instances of the *second* kind are to be found

¹ As before mentioned, both laws of association work together in the production of perception, since the repeated observation of an object strengthens, on the one hand, each simple or partial idea *in itself* (law of similarity), and on the other hand their *association into a complex picture* (law of simultaneity).

wherever ideas to be committed to memory in a definite order are capable but partially of association in thought, and in part must be associated mechanically. Here belongs, for example, the word-for-word memorizing of literary selections. The mechanical memory must in such case, at all events, assist. The whole piece, to be sure, if one wanted, could be committed to memory in an exclusively mechanical manner; but the proper way is to combine both methods in practice. Examples of the *third* kind are longer lists of logically associated ideas; for example, the eight branches of the animal kingdom, or the classes under each of these, etc. Here we might devote our efforts entirely to rational memorizing. But, in so far as a certain facility in reproduction is desirable, it will be better, on account of the length of the list, to call in the help of the mechanical repetition in conclusion.

So far as the right way of handling mechanical repetition is concerned, it must suffice to emphasize a few of the most important measures. And first of all we must recur to the advice above referred to, which, although given by Ratich nearly three hundred years ago, still continues to deserve reiteration, particularly as it applies equally to the understanding of the new as well as to the memorizing of it. The rule is to learn everything "piecely," i.e., in conveniently-sized portions. The second and most important rule is, wherever the method of rational memory can be combined with the mechanical, always to use it, and in such case, in accordance with its higher worth, always to give it the precedence. As a third rule for the cultivation of the judgment, and the prevention of thoughtlessness, it is recommended to have the entire lesson reproduced in conclusion, and, particularly in the case of memorized se-

lections, always to insist on a logical analysis by topics. The practical carrying out of these rules will be shown in the next chapter by some examples taken from the different subjects of the curriculum.

As this ends the general discussion of the subject of memorizing, we will recapitulate briefly its various forms.

Unintentional or immanent memorizing takes place of itself in every lesson in and with the act of acquisition and in every one of the three formal steps in learning, but most extensively in the applications to practice. By the proper arrangement of the course to favor the correlation of studies, this sort of memorizing may be considerably increased. It has three great advantages over voluntary memorizing; first, it takes no extra time; secondly, it is favored by the stimulus of novelty; and, thirdly, it depends, for the most part, although not exclusively, on rational association by thought. How much it therefore deserves to be increased by the proper interrelation of studies, is obvious.

Intentional memorizing, taking place by the help of repetition, divides, according to the two natural laws of association, into rational and mechanical. The mechanical method should never be employed alone on such matters or on such occasions as allow of thoughtful repetition.

When the ideas are not in themselves capable of rational association, it is customary in certain cases to help the mechanical memory by inventing an *artificial* rational association. This means was already known and practised by the ancient Greeks. An example will show how such crutches for the memory are manufactured. Suppose, in history, it is to be remembered that the Roman emperor Theodosius, divided the empire between his two sons, Ho-

norius and Arcadius, giving to the former the western, and to the latter the eastern portion. Here it is evident that the pupils can easily become confused when trying to recollect which was emperor in the east and which in the west. To avoid this an artificial association is attempted in one case between the personal and geographical name. In case the pupils already know the ancient Greek province of Arcadia, this association may take place between the sound of the name Arcadius and that of the province Arcadia; this lay in the eastern portion of the empire, and it was this portion that fell to Arcadius. If the pupils have not heard of that Greek province, the artificial association could be made as follows: the name Arcadius begins with the first letter of the alphabet; in the east the sun rises first; thus the one 'first' recalls the other 'first.' This method of association, as distinguished from the genuinely rational association, is called *mnemonic* (from the Greek word *μνήμη*, recollection). It was named by Kant the *ingenious* memory, i.e., cunningly devised. We call it also *artificial* memory. Mnemonics is, in certain cases, particularly for the retention of dates and other numbers, as little to be despised as crutches and artificial limbs are when the natural limbs are wanting. In its application to numbers this art has in later times been reduced to definite rules, which are easily learned, and in such vocations as require many numbers to be learned it will no doubt pay to drill one's self in the use of these rules. But it is quite another question whether educative instruction should make use of a system of mnemonics in drilling on historical dates and geographical numbers. It might be asked in reply whether one should systematically accustom sound limbs to the use of crutches? That which no gymnastics for the body would permit, may

not be allowed for the mind either. This fact, however, should not prevent the mechanical memory from receiving artificial aid in certain individual cases; for example, to prevent confounding similar ideas — if for no other reason, to call the pupils' attention to the fact that such aid is possible. In our opinion the school should not require any more numbers to be learned than can be mastered by the natural means of memory. If, therefore, a prescribed course of study requires the learning of so many numbers that the natural means of memory are insufficient, this is a sign, not that a system of mnemonics is necessary, but that the list of numbers must be shortened. The method of mnemonics has often been counted as a third kind of memorizing, co-ordinate with the rational and the mechanical methods. With reference, however, to the matter in the association, the mnemonic method is a subspecies of the mechanical memory; with reference to the kind of association, it is a subspecies of the rational.

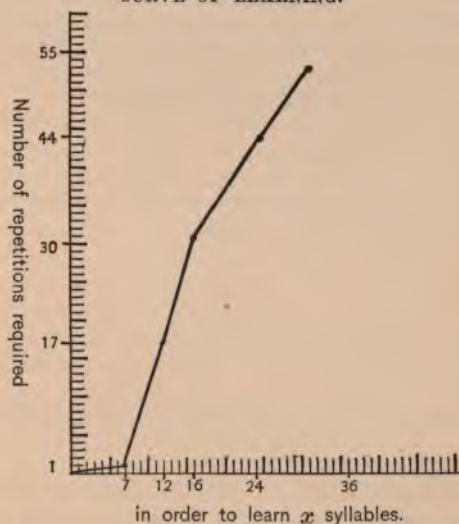
That sometimes our most prominent educators fall into a disparagement of memory, *by reason of restricting it to the mechanical form*, is shown by the following sentence from Dr. Harris's preface to Kay's *Memory* in the *International Education Series*: "When we can see each immediate fact in the perspective of its genesis or history, we have no use for memory, which preserves for us facts and events isolated from their producing and deducing causes." This whole book is a protest against such a restriction in the *meaning of memory*. To see "each fact in the perspective of its genesis or history" is the best way of *memorizing it*. Nearly all the special books on Memory restrict themselves to the cultivation of the mechanical memory, or else advocate some artificial system of mnemonics. This is true of Kay's book above mentioned, and even of Dr. Pick's *Memory and the Rational Means of Improving It*.

For an account of different systems of mnemonics, see article "Mnemonics," *Encyclopædia Britannica*, and article "Memory"

in *Chambers's Encyclopædia*. A very interesting book, calculated to cure any one of unbounded faith in any system of mnemonics, is "*Loisette*" Exposed, by G. S. Fellows, New York. It contains a full bibliography.

Dr. Ebbinghaus of Berlin investigated on himself some of the laws of mechanical memory, and has published his results in a book, *Ueber das Gedächtnis*, Leipzig, 1885. As this work has never been translated,¹ I take the liberty of presenting three of his results which seem to have most direct bearing on school work.

CURVE OF LEARNING.



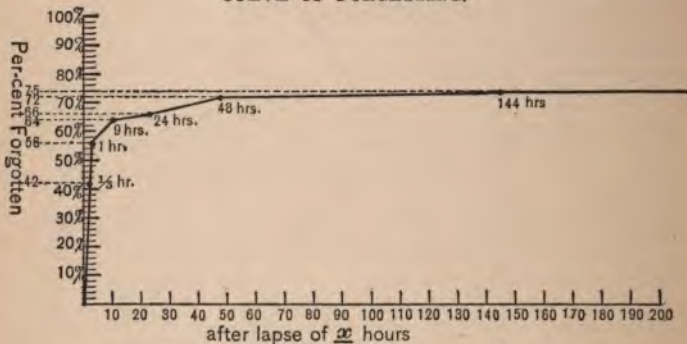
To learn 7 nonsense syllables, Dr. Ebbinghaus found that for him it required but once going over; when this number was increased to 12 syllables it took 17 repetitions to learn the list, 16 syllables required

¹ See, however, a very good summary of the book by Dr. Burnham in the *American Journal of Psychology*, vol. ii., pp. 587-603. The curve given on p. 126 of this book is not taken from Ebbinghaus, but is constructed from his tables.

30 repetitions, and so on. The curve is extremely steep, and shows in a very graphic way the difficulty the memory has of mastering *long* lists. It should be added that when lists were chosen in which the syllables had a MEANING, and could be *thus associated*, it was found the work of learning was reduced to *one-tenth*.

By committing lists of nonsense syllables so that *they could just be reproduced*, it was found that after the lapse of only 20 minutes 58% as much work was required to recommit as to commit an entirely new list; or, in other words, 42% of the original work was lost by forgetting. After one hour this loss amounted to 56% of the whole. But it was also found that the loss after this was very gradual, so that after 6 days there still remained 25%, and after 31 days there was still a saving of 21% in the work of relearning.

CURVE OF FORGETTING.



With six 16-syllable lists, Dr. Ebbinghaus found the time saved in relearning, after an interval of 24 hours, was *directly proportional* to the number of repetitions (up to 64 repetitions) on the preceding day. But this saving amounted to only *one-third* as much time as the original learning required. Hence we see the bad economy of attempting to learn things *before they can be used*, under the plea that they will be of use later. *One great waste of memory in school-work comes from learning things before they are needed, inasmuch as they have to be relearned each time that they are really employed.*

James P. Downs of New York has published a series of six

manuals on *The Memory*. They are, 1, *The Mastery of Memorizing*; 2, *Quickness of Perception*; 3, *Eye and Ear Memory*; 4, *The Study of Languages*; 5, *Memory and Thought*; 6, *The Memory-Training of the Young*. The titles, however, lead one to expect a great deal more of helpful suggestiveness from these books than they actually contain. They have some good points, but are not worth their cost (\$5).

For the English literature of the Herbartian School the reader is referred particularly to Rein's *Outlines of Pedagogics*, translated by C. C. and Ida J. Van Liew, Syracuse, N.Y.; C. W. Bardeen, 1893. This is a book of nearly 200 pages, but as thorough as anything on the subject yet published in English. It contains a full bibliography to date of works in English on Herbartian Pedagogy. Of these I should name as chief: De Garmo, *Essentials of Method*, and *Herbart and the Herbartians*; Ufer's *Introduction to the Pedagogy of Herbart*, translated by J. C. Zinser; Herbart's *Science of Education*, translated by Henry M. and Emmie Felkin; Lange's *Apperception*, edited by De Garmo; Charles A. McMurry's *General Method*. *The First Year-Book of the Herbart Society for the Scientific Study of Teaching* contains valuable papers on Correlation, Concentration, and Culture Epochs. In these works the reader will find a fuller account of "Method-units," or "Method-wholes," "Formal Steps," etc. All of these presuppose on the teacher's part a sympathetic acquaintance with the facts of child development and a good stock of sound common-sense in the correct application of these ideas. ✓

CHAPTER V.

ILLUSTRATIONS TAKEN FROM THE SUBJECTS OF THE CURRICULUM.

WE are now going to illustrate, by some examples taken from the different subjects of instruction, how in intentional memorizing rational repetition may be made to help the mechanical, or even in certain cases entirely take its place. The work of memory is here alone to be considered, and furthermore only that portion that takes place in school. *All the preliminary processes of acquisition will be presupposed.* In those subjects usually classed as *thought-studies* in contrast to expression-studies, it is, of course, the concrete material, and hence the first formal step, which requires the most drill. Of the following examples, therefore, all those taken from thought-studies refer exclusively to the material of observation.

FIRST EXAMPLE — *taken from history.*

The story may be any one the reader chooses, provided it is a method-whole. We will suppose that the oral presentation of the matter by the teacher, including the interwoven explanatory discussion, has been finished, and the teacher has now the duty of seeing that the same is adequately impressed on the memory.

What will be the method pursued by a teacher who makes use of the mechanical memory exclusively?

We must, however, first come to an understanding of what is exactly meant by the expression mechanical mem-

ory, or, in other words, how much place there is here for mechanical association. In history and literature the very words used have, to be sure, a certain value; but we will, nevertheless, assume that the teacher has no intention of requiring a literal commitment to memory, but agrees with us in thinking that the pupils should use their own words in rehearsing the facts of history.¹ Thus, then, the mechanical memory of the words used is excluded. Hence we have to do only with the material facts of history. These form objectively a definite sequence in the story as related, and yet not an accidental sequence, but one that is determined by the causal connection of the events. Now in so far as the pupils have understood this connection at the first hearing, the ideas have already become associated once rationally; but in so far as this connection has not been conceived, the ideas have been associated only mechanically. The fact, as a rule, will be that a portion of the ideas have found a rational, and the other portion only a mechanical, association. But suppose the most favorable case, namely, that in this first immanent impression on the memory the number of merely mechanical associations has been very small. How will it be now in case of repetition? In so far as the pupils have not the logical connection in mind, this connection will likewise fail of repetition. And hence, if the teacher does nothing to freshen up the rational association, it will indeed happen that only a portion of these rational associations are repeated, thus

¹ "I shall *force* my daughter to marry according to her *inclination*," said Madame DeStaël, taught probably by her own sad experience. This maxim may be applied to recitations in the thought-studies. The pupils should not only be *allowed*, but even strongly *encouraged*, to use their own words in recitation. Of course this encouraging must not degenerate into command, for then freedom would be lost again.

increasing the number of mechanical associations in the same degree. This will be especially true with the weaker pupils. With this preliminary explanation, it will now be possible to say how the expression "mechanical repetition" is to be understood. It means that in such case the teacher does nothing to renew and deepen the *conception of the connection* of the ideas, but restricts himself to a mere drill of the concrete ideas in the given sequence.

Returning now to the above question, we shall follow the method of mechanical memory in detail.

To begin with, the teacher, of course, will mentally divide the story into smaller divisions. But this is done only in the mechanical sense, and therefore not for the sake of disposing the subject-matter logically, but for the sole purpose of giving the pupils conveniently small portions. Accordingly, then, these divisions will not be provided with special headings. For this method does not require the pupils to think of these divisions as members, but only as pieces, and, of course, broken bits need no names. Hence in the division of the subject-matter these pupils take no part.

And now the memorizing begins, namely, with the first paragraph. The teacher presents the matter once more, either orally or by having the pupils read; in case it seems necessary, this may also be repeated a second time perhaps.

Then he calls upon one of the abler pupils to repeat independently, and corrects, or allows the other pupils to correct, whatever is in need of improvement; thereupon he calls on one of the mediocre pupils to repeat, and finally on one of the weakest. Thus reproduction and correction are continued so long as is necessary to enable most of the

pupils, and, if possible, even the weaker ones, to accomplish what is desired.

After this the second paragraph is taken in its turn, in the self-same way. But this time, in reciting, the pupil is required to say both paragraphs together. The same takes place with every succeeding paragraph, until finally the majority of the pupils are able to reproduce the entire story with certainty, and even a certain amount of facility.¹

That would be just about the method pursued in the mechanical memorizing of history. It is characterized, as one sees, by the fact that rational association in thought is nowhere made use of. Compare with this the other method, which, in contrast, depends directly on the rational association.

The first place in which thought here comes to the assistance of memory is in dividing the story into smaller sections. This division of the subject takes place at the first presentation for greater ease in the acquisition; also, with the same purpose in view, the separate sections are

¹ Rector Dörpfeld records, in a footnote, how he felt, when at the time of the Regulatives (1872) he first came upon the practice of the last-named regulation in regard to repetition. He found the students in a Normal School trained to teach in this way. He had supposed it was impossible after the introduction of Normal Schools, to find such perverted ideas of teaching. He wrote at that time in the *Evangelical School Journal*:—

“Does it not seem as if one had already seen this sort of smart work elsewhere, and in other connection before? Is not this manner of committing to memory precisely like that old way of learning the spelling lesson, in which with every successive syllable of a word the preceding syllables had to be again pronounced, after the manner of the ‘house that Jack built’? Thus it would go: te—e=tē; de—i=dī, tēdī; o—u—es=oūs, tē’dīoūs; en—e—double ēs, nēss, tē’dīoūs-nēss. What is here done with the syllables is just as regularly done there with the sentences and paragraphs of history.”

provided with a *general heading*, or topic. Thus we see the difference of the two methods even in the very first step; for the topical headings prevent the matter from being cut up into arbitrary pieces, and substitute instead the *logical disposition of the subject*. Thus the sections become actual members of an organic whole, instead of merely loose pieces. Every heading is to be, as much as possible, in the form of a catchword. For a very good instance of such logical disposition compare the topical analysis by Dr. Hill in Fiske's *School History of the United States*. Here, for example, the period of the Revolution is divided into three chapters: I. Causes and Beginnings, 1763-1776; II. The Winning of Independence, 1776-1783; III. The Critical Period, 1783-1789. Under I. are the topics and sub-topics as follows:—

a. Causes of Ill Feeling between England and her Colonies.

1. What was the European idea of a colony, and its object?
2. What erroneous notions about trade existed?
3. What was the main object of the laws regulating trade?
etc.

b. The Need of a Federal Union.

1. One great difficulty in carrying on the French wars.
2. An account of Franklin.
3. Franklin's plan of union.
etc.

c. The Stamp Act Passed and Repealed.

1. The kind of government needed by the colonies.
2. How Parliament sought to establish such a government.
3. The nature of a stamp tax.
etc.

First Stage in Memorizing. If the first step in acquisition (the concrete presentation) has thus prepared the way,

the work of memorizing will now begin as follows. The first stage consists in committing well the logical disposition, that is to say, the *list of headings*. This is done by repetition, not, however, mechanically, but thoughtfully. The teacher, accordingly, in the simplest possible manner, calls attention to the fact that the members of this series are not accidental but causal in their connection. He shows that the Causes (I.) of the Revolution led to the Winning of Independence (II.), and this was then followed by the Critical Period (III.), lasting until a stable government could be established again (IV.). After in this way the list has been gone through, once forward and once backward, it may be thoroughly stamped on the memory by the following exercise, in which the teacher questions and cross-questions thus, — e.g., What was the cause of the Critical Period? What led up to Independence? What followed on the Winning of Independence? etc. But in all of this the pupils must be allowed opportunity for quiet deliberation; for the aim is not to get the answer as quickly as possible, but to get it by *thinking*. If this exercise is continued awhile, all the pupils will soon be able to say the list both forwards and backwards, perhaps with facility already, and, at all events, with certainty.

This shows, in the first stage of the process, how thought may re-enforce memory through a logical arrangement of topics. The help that the memory receives is easy to see, on the one hand from the arrangement, and on the other hand from the repetition. The contents of each section is held together by its separate heading, and the story is connected, as a whole, by the entire list of headings; this is in both cases a thought-connection. The repetition then strengthens both of these bands, but always retains its

logical character, and hence this thinking seems to the pupils like new acquisition.

Second Stage of Memorizing. Now, then, can follow the repetition of the separate sections. As the reader will remember, we described above (p. 109) two forms of repetition,—the one a strict repetition of the original act of learning, and the other a reproduction in memory of its results only. In this case the first or *productive* repetition must take place, inasmuch as the matter is to be re-presented exactly, and without weakening in its effect. In the lower grades, therefore, the teacher has no other way than to relate the sections in question once more orally, but now, of course, in a somewhat briefer form. In the middle and upper grades such a repetition would be tedious to the pupils; besides, they are justified in wishing to take a larger part in the work themselves. Fortunately, there is a way of securing all of these advantages, and not losing any of those obtained by oral repetition. The teacher has only to let his pupils *read* the story for themselves in their books. For, first, the matter is thus presented again just as exactly as before; secondly, opportunity is given the pupils for self-activity, and tedium is avoided; and thirdly, their facility in reading is also increased. It would, therefore, be simply folly not to accept these advantages when they thus offer. That any one should think it unnecessary at all to refresh the memory thus exactly in the one way or the other, I shall leave out of consideration entirely. In this manner, then, the first section is read.

This is the place to call attention to an important point. The advantages to be gained by this reading, and in particular its memorizing effect, may be very noticeably increased by the introduction into it of a thought element. This

may be done by making use of questions, i.e., by putting analytical questions, whose answer can be read from the book, thus converting the monotonous reading into a vivacious dialogue, as it were. Of course the teacher must not spare himself the pains of preparing such questions beforehand, because they cannot be made up on the spur of the moment in just the fitting form. As already indicated, the main object of this is to introduce a logical element into the reading; for the question that precedes places the content of the answer under a *particular point of view*. But it accomplishes still more. Every question is, as it were, a finger-post, pointing to a definite place, and hence causing a sharper apprehension. Besides this the preceding question leads the pupil of himself into the correct emphasis. Counting all of these results together — thought element, sharper apprehension, vivacity, right emphasis — it is manifest that the resulting power of memory is by this means very considerably strengthened. Whoever has once tried the plan of letting his pupils read in answer to questions will not want to give up the method, even if its only advantage were the increased vivacity.

Third Stage of Memorizing. — Thus, then, after the first section has been reviewed in the stricter form, namely, by repeating exactly and completely the original process, this may be followed by the *reproductive* repetition. But this must not be done by simply calling for a recitation of the whole section, and depending entirely on the monotonous repetition of this command and the equally monotonous repetition of the same matter until gradually even the weaker pupils have gained a certain facility. To do so in this final stage of memorizing, where of right quiet deliberation, freedom, and alertness should be the rule as much

as in the two preceding stages, would be to cultivate tediousness systematically; it would mean the renunciation of the increased attention, stimulus, and vivacity resulting from the use of questions; it would mean, in short, to imitate the purely mechanical method before described. The correct way is for the teacher to proceed again with analytical questions, i.e., to have the reproduction come in answer to questions, just as before in the case of reading. Accordingly these questions for reproduction will cover the same ground as those questions for reading, or at least they may do so. The particular forms of expression may be changed as much as practicable, in the upper grades, perhaps, by using language that is somewhat more difficult and technical. One may see from what has been said that only such questions are intended as require a rather long answer; they should analyze the section, but not pick the separate sentences to pieces. Questions that concern merely one portion of a sentence, or a single word, do not belong here at all. The reasons for the use of questions in reproduction are the same as for their use in reading, and hence we need not repeat them. There is, however, in the case before us one new reason, namely, that this method is *easier*. This carries with it the further advantage that the duller pupils, perhaps even the dumbest, can answer independently at the very first, thus relieving the teacher of the tedious necessity of requiring these slower ones to repeat after the brighter ones. If this were its only advantage, the questioning would, even on this account alone, be fully justified; but with all the other numerous advantages added, it becomes completely inconceivable how there can be any teachers who will give up this way, and prefer to torture themselves and their pupils with their monotonous

mechanical memorizing.¹ After the first section has been repeated in this way in answer to questions, topically, it will of course be recited once more *connectedly*,—but again not at a mere word of command, but in answer to the topical question contained in the heading. The brighter pupils need not be required to give this final repetition, but only the duller ones, as we may take for granted that the others are able to do it after the preceding exercise.

In this way the first section is gone through. The succeeding sections are then repeated in the same way, first by reading and then by reproduction from memory. There is, moreover, in my opinion, nothing to prevent the pupils from reading the entire lesson at once, and proceeding by sections only when they come to reproduce from memory. This is, perhaps, on some accounts, the more desirable method, seeing that the whole selection has been presented in its entirety, and the logical disposition has likewise been memorized.

The question now remains, whether, in this method of repetition by sections, some special means does not have to be taken to enable the pupils to recite the *whole story connectedly*. There is no doubt at all that school instruction should include this in its object, and should aim to enable the pupils to *command long trains of thought* and to recite independently. If this demand is understood, as it is here meant it should be, to apply to only a single recitation and

¹ It may be mentioned, in passing, that this form of questioning enables the teacher to make use sometimes of the method of "repeating after" in quite a different and really *stimulating* manner. The teacher may, namely, now and then, when it seems desirable, have one of the duller pupils repeat the *question* as put to him, or to one of the brighter ones.

for the time being, and not for all future time, the task is certainly not too difficult. But much time will be needlessly lost and the teacher will be sorely tempted to recur to the mechanical routine, if he knows that the final examination will likewise demand such ability of reproduction. The mechanical method accomplishes this end, as we have before seen, in its own peculiar way, by repeating the first section along with the second, and in this manner with every succeeding section reciting all the preceding over again. That this means secures the end, particularly when the mediocre and duller pupils are required to repeat after, admits of no doubt. But there is likewise no doubt at all that this procedure is most exceedingly tiresome for all concerned, but especially for the brighter pupils. There is a second evil which must not be overlooked. By the continued precedence of the brighter pupils, all the others in the class are forced into their particular mode of expression, and thus the repeating after can no longer be called an independent recitation. If the former used their own words freely, the others imitate their mistakes as well. The three evils are, therefore, much tediousness, restriction of free reproduction for the majority of the pupils, and the copying of a model unfit to be imitated. There is, however, fortunately another way, which, though safe and faultless, seems to suffer only from not being known to the advocates of memory-cram. In the main, it consists in what neither costs time nor makes the least trouble, because all the while this work has already been done in the foregoing exercises of rational memory, as they have been described. In a word, it consists chiefly in the fact that these exercises from beginning to end have made use of the *thinking memory*. The considerably greater intensive power

of memory by rational association, together with the various other advantages (avoidance of tediousness, increase of interest, vivacity, etc.), bring it about that at this stage in the process that command of the whole thought is in the main already obtained. The small residue that must yet be done will consist in the pupils' reading the lesson over at home, preferably aloud, — of course, by questions again and with regard for the logical disposition. This final review of the lesson is, in respect to the ground covered, exact and complete; in respect to its character, since it takes place by questions, it is thoughtful; and it takes up none of the time in school. This one review at the close of the lesson is the only work of memorizing that should be left for the pupils to do at home, so far as the concrete material is concerned. The practice thereby gained in reading is sufficient reason for requiring this work to be done.

Assuming that the foregoing exercises of the thinking memory have done their full duty — that is to say: that, first of all, the immanent memorizing has not been wanting which comes from the thorough, concrete, oral presentation; that, secondly, each separate section has been read over as well as recited from memory, and that both have been done in the thoughtful way; that, thirdly, these sections are firmly connected in mind by the logical disposition; and, lastly, that the pupils have read them over thoughtfully once more at home — if this has been done, I say, there can be no doubt that pupils of all grades of ability will have at least as much command in the connected recital of the story as the mechanical memorizing can accomplish in the same time, in spite of its special exercises for this express purpose. Those in authority, unfortunately, have too often been willing to overlook the

deficiency in power to think and the resulting lack of interest in the subject, if only the required per cent was obtained in examination.

If, after all that has been said, any one still has doubts whether this particular object, viz., the ability to recite connectedly the whole story, can be reached in the way described, it nevertheless certainly does not follow that we are forced at last to return to the tedious mechanical method. For what is there to prevent, if need be, the repetition of any of these exercises, whether of the reading or of the recitation from memory? There is, however, to be sure, a still better means, which on the one hand is new in form, and on the other hand affords a desirable help to the weaker pupils. It consists in assigning to the brighter and mediocre pupils the presentation of the story in writing, while the teacher in the mean time reviews one of the preceding oral exercises with the duller pupils. In brief, my theory of memorizing does not prescribe how frequent the repetition should be made, but it does demand that the repetition shall not be mechanical and, above all, shall not be tedious or tiresome, but should always make use of thought by means of logical disposition, and well-directed questions.

This is now the place for a brief summary of the character and advantages of this mode of memorizing in the case of historical subjects.

So far as their character is concerned, the repetition exercises above described are by no means a combination of the rational and mechanical modes—as my introductory remark might have led one to believe—but on the contrary they are, from beginning to end, exclusively thoughtful in their nature. For the mechanical association is

never intentionally used, and the connected recitation of the matter without questions occurs not as an exercise in repetition, but only as a final reproduction in the form of a test.

The advantages are as follows:—

1. The association in thought makes the power of memory in these repetition exercises *intensively stronger*, thus saving time, — to say nothing of the fact that this power is extended to a much *greater number* of associated ideas, thus becoming *many-sided* in the reproduction.

2. Whatever strength the mechanical association has in each repetition belongs each time, as a matter of course, to these thought exercises — as a *free gift*.

3. The pupils must be constantly *deliberating*, and are therefore forced to keep their thoughts on the subject, and pay attention to *content* and *expression*.

4. The *tediousness* of mechanical memorizing is not present.

5. The *language work* receives a considerable advancement in facility of reading, which, moreover, returns to re-enforce the further learning of history. The brighter pupils have besides an exercise in written composition.

6. Inasmuch as fewer repetition exercises are necessary, and since those that are used are considerably more stimulating and lively, and therefore more interesting, the *disgust* and *dislike* for the subject which is so prominent a weakness of the mechanical routine is, so far as possible, avoided.

SECOND EXAMPLE — *taken from the natural sciences.*

The subject matter in the natural sciences is essentially

different from that in the historical subjects, in so far as in the former the new ideas arise as direct sense-perceptions, while in the latter they must be produced by means of language on a basis of imagination. In this immediate apprehension through the senses, the natural sciences have a great advantage to begin with. But this advantage extends also to the memorizing in several ways. In the first place, the ideas of sense are stronger than those produced by the imagination. Secondly, a natural object, in case it is a body or a physical process that is being studied, is *continuously* before the eyes for observation, so that in this way the separate characteristics, so far as they are apprehended at all, have already experienced frequent *repetition*. Both circumstances combined must have the result of taking less time and trouble for the voluntary commitment to memory than are required for lessons in history. But there is still a further advantage. As we saw in the first example, the different errors and mistakes in memorizing historical matter are connected with the fact that here the ideas must be conveyed by language. The agency of language easily misleads into mechanical repetition, and, moreover, to make use of book-learning in the wrong place. In the case of natural science subjects the teacher is not so liable to be led into these mistakes. For the logical disposition (1st stage) almost forces itself on him; to refresh the ideas (2d stage), he is warned by the very nature of the subject to have recourse to observation again; and in the succeeding recitation from memory (3d stage) the preceding logical disposition suggests to him the desirability of judicious topical questions. It will, therefore, not be necessary to describe any particular lesson in natural science, especially since there are so many

branches, chemistry, physics, botany, zoölogy, meteorology, geology, physical geography, and astronomy, that the differences in the subject matter lead to many differences also in the method of teaching and in the appliances used. An example taken from only one of these branches would, therefore, not quite fit any other, and hence could easily lead to misunderstandings. I shall therefore mention only such measures as either apply to all the branches, or at least show plainly to what particular ones they do belong. The remarks will naturally be connected with the three stages of memorizing above noted. In the first stage, as we know, the logical disposition, which the pupils have already sketched in the work of observation, is to be committed to memory. In describing a plant or animal the logical disposition, to be exact, must be branched into main divisions and subordinate sections, instead of being a uniform sequence. But such a branched sequence may be just as easily retained as one that is uniform, provided it is well understood,—indeed it may even be easier, since, in the form of the plant or animal, everything is present to the eyes at the same time.¹

In the second stage, where the memorizing of the separate sections begins, the repetition, in order completely to refresh the ideas, must fall back on immediate observation. When the most important points have been reviewed in this manner, the section may then be read for completeness,

¹ Of course it is to be understood that such descriptions in the lower and middle grades must be thoroughly simple in their nature. Even in the upper grades they should not lose themselves in minute details, but ought constantly to have reference to such characteristics as are of especial importance either for the life of the living thing, or for its æsthetical bearings, or as a means of recognition.

provided the matter is appropriate to such an exercise. In this case the reading forms the transition to the recitation. The reading is, however, not necessary so far as its object is merely to impress the matter on the mind; for natural science has an immense advantage in the fact that its ideas are obtained by direct observation. But the reading is, nevertheless, useful; first, because of the repetition in a new and different form; but secondly, and mainly, because the pupils are thereby better prepared for later self-instruction, since a written description is always more difficult to understand than a free oral explanation. The final decision, however, whether in the natural sciences the lessons should be read so far as the subject matter admits, does not belong here in a work on the memory, but rather to the subject of the correlation of studies. It may, in certain cases, be much better to assign such reading to the language lesson than to that in natural science.

In the second stage of memorizing the drawing of natural objects has special value, being indeed indispensable as a means of exact apprehension and retention. It may perform good service even in the history lesson. This work, however, must not be confounded with the proper and regular instruction in drawing.

The third stage of memorizing is the recitation from memory. This will, of course, be oral usually, but a written exercise at this stage is recommended, whenever the teacher has to give his attention separately to the weaker pupils, and also now and then as a home exercise for the entire class. It need hardly be remarked that such repetition must be thoughtful and not mechanical. Hence, wherever the logical disposition is insufficient, the teacher will find it serviceable to make use of judicious sub-ques-

tions. If, for example, a plant leaf was to be described, there could be distinguished first the petiole and the blade, and in respect to the latter whether simple or compound, etc. Practise in connected recitation is not excluded by this exercise.

For the written reproduction, whether a connected description is intended or not, as well as for the review at home, printed questions for review are desirable. This is particularly necessary in order to render the home review an exercise in thought, and prevent it from degenerating into book-learning, that is always half mechanical, and, in the case of a dry outline, is in addition as tedious as it is unfruitful. In physical science these review questions can be and must be, for the most part, genuine *exercises for application*.

From both of the above examples the reader will be able to conclude that, in our opinion, the work of memorizing should be done *in the school*, exclusively so in the first and second stages, and for much the greater part in the third stage of the process also. This applies equally to all the subjects of instruction. Only a small and easily accomplished residuum of work should be left to the private industry of the pupil at home. In this way not only is every over-burdening prevented, but the proper means will thus be taken to insure zest in the work of memorizing.

THIRD EXAMPLE.

Such studies are here included as, in comparison with the foregoing examples, contain a new element, in that, besides the thoughts expressed, also the form of expression is to be learned,—such selections, therefore, as are to be

committed to memory word for word. Of course occasion for such selections may occur in almost any of the subjects of study: in literature, in history, in singing, etc.

In such a case, before the pupils begin to memorize the work, the thought content of the selection should first be worked out by the regular method, i.e., according to the formal steps of apperception, viz., observation, thought, application. This will insure not only the understanding of the general thought, but also include the proper explanation of unfamiliar words and phrases. Short pieces to be committed to memory, as, for example, a proverb or a stanza of poetry, which occur as accompaniments of a history lesson, of course receive the explanation in that connection.

The memorizing of words, apart from any help derived from their meaning, must depend, of course, on the law of simultaneity. Memorizing is, therefore, in such case mechanical. Since the purpose of such memorizing, just as in learning a song, consists in reaching the greatest possible certainty and ease in reproduction, and since in this case the facility, and in part also the certainty of memory depends chiefly on the mechanical association of ideas, the drill in repetition, of course, must not be given up until this result is reached. Taking thus much for granted, we may now enquire whether, in this case also, rational association may not be called in to the assistance of mechanical memorizing. This can most certainly be done, and its advantages are most plainly manifest just where the mechanical method gives the most trouble, namely, in selections of greater length. What the teacher can do in this direction may be told in a few words, after what has been said in the previous examples.

First Stage. Even the mechanical method requires the selection to be divided up into smaller sections. For the sake of rational association this requirement is so far modified that the sections must be not mere fragments, but actual members; in short that this division of the subject into parts must be a logical disposition by topics. The work of memorizing begins, then, by committing this logical disposition with considerable thoroughness.

Second and Third Stages. In the middle and lower grades, each separate section will now be read and re-read. This is essential, if for no other reason, to gain the correct intonation and whatever else is necessary to a good delivery. The other exercises that go along with this — such as trial recitations from memory by the brighter pupils, home rehearsals, etc., — need no detailed description here. The one feature of the work which, from our point of view, is the most important, is that in all of this reading and recitation the *logical analysis must ever be present in mind*; for without this the help to be gained by rational association is lost. Whenever a section is read or recited, the topical heading should be given every time, — whether by the teacher, or by the pupil reciting, or by one of the other pupils, depends upon circumstances. The same, of course, is to be observed when several sections or the entire piece are read or recited. In a word, reading and recitation should come constantly in answer to questions, — which implies that in the case of longer sections sub-topics should be inserted also. In this way the association in thought keeps pace, hand in hand, with the mechanical process.

The advantages of this manner of treatment have already been spoken of. But since the help of rational association is doubly necessary in such cases as that just mentioned,

whereas in practice it is but seldom employed here, it may be well to recount at least some of those advantages. In the first place, the mechanical repetition in this way gains in vivacity and interest, and so becomes less tedious. Secondly, it becomes easier, and the retention is likewise strengthened, since two bands hold stronger than one alone. In the third place, the ideas are made more capable of reproduction for a further elaboration in thought at some future time; which fact is here all the more important, because the continued drill of mechanical repetition confines them so firmly in its one-sided association that they are on this account all the stiffer and less fruitful for other combinations of thought. Fourthly, the pupils are necessitated to keep their thoughts constantly on the subject, both as to meaning and form of expression.

FOURTH EXAMPLE — *taken from arithmetic.*

This study is fortunate in allowing of diligent memorizing without the need of mechanical repetition. But there used to be one place in arithmetic that was heartily detested by the pupils on account of its tiresome mechanical memorizing; and there are probably many schools still where, in this matter, the acquisition is more irksome than is necessary. This part of arithmetic to which I have reference is the multiplication table. We will conclude by a consideration of this subject, in order to call to mind how these two antipodean methods of memorizing appear in the field of number.

1. What is the mechanical mode of drill, for example, on the number 2 in the multiplication table?

As a sensible person, the teacher of course would not let

anything be committed to memory that was not understood. Accordingly, the numbers from 1 to 20 have been learned previously, we will suppose, on a basis of concrete observation. Besides this, exercises in addition and subtraction have already been practised within this range. Now, a new chapter in the difficult science of number is to be learned, namely, multiplication. Therefore the teacher will, of course, provide for the necessary concrete understanding of the process. For this purpose he draws two chalk marks on the board, and then again two more, thus $|| + ||$; the pupils count them up correctly, $= 4$ marks; then he draws three times 2, then four times 2 marks; the pupils add again of themselves, $= 6, = 8$ marks. When this has been continued to ten times 2, and this addition has been repeated several times, it might be supposed that the subject was clear to the pupils. The next step is to introduce the new expression "times," and so translate the exercises in addition into multiplication. Thus much being accomplished, and therefore all the requirements of concrete instruction having been fulfilled, the work of committing the columns of the multiplication table could now begin. The mechanical way in which the children perform this part of the work is only too well known.

2. Now contrast with this the mode of procedure that makes use of the rational memory.

The purpose of what follows is not so much to show how to teach the multiplication table, for most teachers think they know that already, but rather to call attention to a certain peculiarity in the rational association of numbers, and to the pedagogical results of this in practice. The purpose is, therefore, more psychological than pedagogical. That which everyone thinks he knows is not usually

taught, and even the text-books on psychology are wont to pass over the subject in silence.

The concept of number is, as was incidently remarked before, a concept of relation. That is to say, in the case of a number we are concerned with a characteristic of relation, and that not only in its *conception* but also in its *perception*, viz., with the relation between unity and plurality; for example, the perception that the number 5 is five times as great as 1. Now, since the characteristic denoted by the name of the number is one of relation, its concrete apprehension presupposes always a previous comparison — just as the pitch cannot be distinguished in a single sound by itself, but only when two sounds of different pitch are compared together. This presupposed comparison is one reason why the concrete apprehension of a number is not so easy as is generally thought. But there is a second difficulty. As a characteristic of relation, enumeration is not a material quality of a number, but something entirely formal; in order to grasp this formal characteristic there must be, therefore, first an abstraction of the material characteristics. Thus the concrete apprehension contains impliedly both the mental processes of comparison and abstraction, which otherwise only occur in conception. As a matter of fact, in arithmetic the formation of the concept, i.e., the transition from denominate to indeterminate numbers does not give children the most trouble, but just this process of *perception*.

This explains why it is that, among savages, adults frequently cannot count beyond ten, sometimes not beyond five. The concept of pure number is, however, always present even with these people, at least in its spontaneous form, as soon as they can count to two; that is, as

soon as they are in possession of two perceptions of number. So, too, with our own children; nearly every parent is at first probably so astonished at the arithmetical stupidity of his first-born as to have serious doubts whether the child will ever grow up to count to a hundred. Preyer's child at twenty-nine months, although he could talk well enough, and say over the numbers up to ten, could not apply even "two" and "three" correctly. At this period, however, he was taking his own method of learning,—a very suggestive method, by the way,—and was counting everything by ones. He would put up a ninepin, and say "one," then another, and say "one more," then a third, "one more," and a fourth, and so on, each time counting "one more," although not naming the sums. A little girl of two and one-half years that I know uses similarly the expression "more ball" for each additional ball in counting by ones. I tried in vain, by the use of objects, to teach a little niece of mine, when she was two and one-fourth years old, to distinguish "one" and "two." She was bright and eager enough, but she could not get it right half the time. Another little girl of three and one-fourth years, who can entertain you with stories and talk by the hour, can say the numbers up to twelve in order without trouble, but cannot yet discriminate in the use of "three" and "four." In the case of weak-minded children this is more apparent still. Ireland reports a boy ten years old, at the Larbert Institution, who knew all the colors, and was learning the alphabet. He formed an estimate of the character of those around him, and had some notion of moral relations. He talked volubly on childish subjects, but was so deficient in arithmetical power that he seemed "at nine years of age to have no conception

even of a unit. He would say that he had three heads, touching his head several times with his fingers." The following year he mastered the idea of two, and could count cautiously up to three. Verily, there is a great deal more than mere memory involved in learning the multiplication table.

The perception of a plurality, for example, of the number 6, is not completed by a comparison with unity alone; in order to be entirely clear and perspicuous, the comparison must be made with all the intervening numbers also. Full perspicuity is, however, not secured even by this. Side by side with the building up or synthesis of a number, its analysis must likewise be perceived; and, in the former case, its composition by multiplication as well as by addition, in the latter case its decomposition by division as well as by subtraction. The division must appear likewise in both the form of finding the number of equal parts, and that of finding the size of the equal parts into which a quantity may be divided. Now, to be sure, what the pupil actually perceives in the synthesis of a number by addition, and in the analysis into the same parts of the same number by subtraction, is exactly the same in the two cases; but each operation has a different result and, moreover, a different way of expression in language. It is, however, just this difference in the way of expressing the process that makes the second operation seem like a new one to the pupils, and hence causes the difficulty in understanding. The same is true of the other corresponding operations.

Now what conclusions can we draw from all this regarding the proper method in arithmetic, so far as concerns numerical relations only?

First, of course, this, that every number must be com-

pared not only with unity, but with all preceding numbers, and that this comparison must be by all four *resp.* five fundamental operations.

Secondly, this, — and here we return to the question of the right mode of memorizing, — that if the pupils are to learn arithmetic in the easiest, quickest, and most fruitful way, then they must everywhere memorize by thought, and never mechanically. This, of course, is just as true of addition and subtraction as it is of multiplication. That is to say: we should never attempt, by means of mechanical association, to have the pupils impress on their minds the *result* of a problem; for the full value of arithmetical exercises does not lie in the quick retention of their answers, but in always solving the problems by *thinking*, i.e., by clear, self-confident perception. For the perspicuity thus gained in the perception of numbers involves everything else, knowledge of them as well as skill and facility in their use. The retention of results in any other way than by thought is force-work, resulting in precocity of facility at the cost of genuine knowledge, and in the end the learning of arithmetic will be made difficult and slow.

Still a third monition follows from the discussion above. If the pupil has perceived the synthesis of a number by the addition of all the various combinations of its constituent numbers, there is properly nothing more left for him to understand about this number. For he will be able at once to solve all problems in the other fundamental operations with this number, provided they are presented to him in known terms, that is, objectively. What he has to learn new is, in reality, only the new expressions for these different operations. Of course this includes the practice also which is necessary for facility in operating with these

expressions. This being so, it follows in teaching that every succeeding comparison of this number with its component numbers in subtraction, multiplication, etc., at first must be expressed in terms already familiar to the pupils, to insure facility of perception when the new expression shall be given. They should not be allowed to get the idea that decomposition of a number by subtraction, etc., is anything new to be learned. If this mistaken idea is once allowed to form, they become confused by the new expressions, and in this way the subject is unnecessarily made twofold more difficult.

As a fourth inference, this is to be mentioned. The apprehension of numbers by perception is so important and critical alike for their understanding and for facility in their use, that so soon as the numbers in the short range from 1 to 20 are altogether really clear through and through in all their relations, the chief work for the entire range of numbers is already accomplished, both as to ability to understand as well as for facility in their use. *Let the teacher stop and just think for a moment what that implies.*

We proceed now to describe the method of teaching the multiplication table by the use of the rational memory. For the sake of comparison with the mechanical method we will suppose that, as before, addition and subtraction have been carried through the whole range of numbers to twenty before multiplication and division are taken up. By rights, of course, as before remarked, each number should be carried through all four operations from the beginning.

The difference between the two methods shows itself at the first step, in the objectivation of multiplication by the

addition of like quantities. This difference appears in two ways. The objectivation occurs, of course, in both cases; but, whereas the mechanical teacher goes over at once to new expressions for multiplication, and leaves the drill of repetition till later to be carried out in this new form, the more thoughtful teacher would begin this drill immediately in the form of addition. And also, whereas the former in his succeeding exercises aims at impressing on the mind only the answers (products), the latter gives his attention constantly to the repetition of the act of thought (perception), knowing as he does that the results will come of themselves. Accordingly he asks, always in the forms of addition, how much is $2 + 2 + 2 + 2 + 2$? $2 + 2 + 2$? etc., at random, and not in the order of the table. He is not so much concerned to have the pupils answer as quickly as possible, as he is to have them keep pace with him and give the sum correctly, while he slowly gives out the quantities to be added. For the activity on the part of the pupil should be nothing but a repeated act of thought; and in order to secure this, and prevent the so-called "learning by heart," the teacher departs from the regular order in his questions, and by speaking slowly allows the pupils time for deliberation. This thoughtful repetition is continued, orally and in writing, until a certain amount of facility is acquired. It is not necessary to increase this facility to dexterity, because these exercises will occur again in many different forms; besides, to continue too long in one and the same form would also become tedious.

The next modification is with the use of expressions for subtraction. The teacher asks, How many are left, if one takes away 2 marks from 4 marks? if one takes away from 6 marks 2 marks, and then 2 marks more? etc. After

this subtraction has been continued in the sequence indicated as well as at random for awhile, the third form is introduced with expressions indicating multiplication. I say "indicating multiplication" because the children ought not to regard multiplication as a new mode of reckoning, but only as another form of expression for an already known thing, viz., the addition of equal quantities. Much depends on this, because one should seek to make a new work easier for them, rather than more difficult. The only thing new at present is the expression "times," and this gives no trouble. The teacher asks: $|| + || + ||$ are how many times 2 marks? and so on with other similar examples. Thereupon, the already familiar exercise may be taken up, using the *new expression*: How much is 3 times 2? 4 times 2? etc.

After this form also has been practised awhile in ascending and descending order, and at random, always being careful to *give time for thought*, the transition to division may be made by using the expression "times" first for the already familiar decomposition by subtraction; for example, how much is left if you take away from 8 once 2, two times 2, three times 2? etc.

Finally, the same exercise appears in the fourth form, with expressions for division (but only in the sense of being contained, not in the sense of dividing into parts). Ask: 6 is how many times 2? 8 is how many times 2? etc. Further, in order to introduce the new expression "is contained," use this form of question: If you have 6 apples in your pocket, how many times are 2 apples contained therein (i.e., in your pocket)? Again: how many two-cent pieces must one take in order to have ten cents? etc. This should be carried out with still other forms of expression.

Now, if the processes of arithmetic involved in learning the multiplication table have been repeated thoughtfully in this fourfold form, there can be no doubt at all that the products will be better committed to memory than would be possible through learning them by heart mechanically. And not only is this purpose fulfilled, but all tediousness is avoided, since the pupils are constantly kept thinking and therefore interested. Besides, this work has given the pupils but little trouble; and finally, what is more important than all the rest, the numbers from 1 to 20 — so far as concerns their composition and decomposition by the number 2 — have become thoroughly clear to them in thought, including therefore facility in practice.

One more point requires attention. For the sake of comparison we have presupposed that addition and subtraction were learned throughout the whole range of numbers before multiplication and division began. This, however, brought us to the difficulty of not being able to complete the subject fully. For while we could take up the case of one number containing another, the division of a quantity into equal parts could not be treated until the pupils could use "times" 3, 4, etc., up to 10. This difficulty, therefore, shows us that this presupposed restriction to addition and subtraction would be a mistake. A second mistake is also shown in the fact that multiplication and division were treated of even numbers only, which restriction, however, was not at all necessary. As already indicated, the theoretically right way would be to treat all four fundamental operations at every step; or, more exactly expressed, to compare every number with the lower numbers in all four *resp.* five fundamental ways. By leaving multiplication and division until addition and subtraction have been

finished throughout the table, the difficulty of thought is increased both in understanding and in memorizing the new processes. The restriction to addition and subtraction may, nevertheless, have a certain amount of justification in so far as it is made to apply to the very first numbers—say from 1 to 6. But in the case of 6 or 8 the two neglected operations must certainly be made up immediately, and with every succeeding number all four operations should be treated together.

CHAPTER VI.

SUMMARY AND CONCLUSION.

AFTER the foregoing psychological and pedagogical investigations, we may now stop and look back over the field and see clearly how thought and memory are related to each other in the work of instruction—as well in regard to the peculiar significance of each for the development of the mind, as in regard to their interrelation and mutual re-enforcement.

Thought is necessary, along with observation and imagination, in the acquisition of knowledge; and its particular office here, in distinction from that of observation and imagination, is the production of *higher* forms of knowledge.

The office of memory is to retain the ideas thus acquired, or, more exactly, to make them easy of reproduction, i.e., to furnish thought the material from which, along with new perceptions, it can create new and higher products of knowledge—including the carrying out of these ideas in practice.

The two activities, accordingly, bear the same relation to each other in their importance as do earning and saving, or gaining and preserving. But since this preservation is not a purpose in itself, but is only for the sake of making possible the enrichment and practical utilization of one's possessions, we may also say: thought and memory bear the same relation to each other as do end and means,

or as do master and servant. This comparison will also define their relative rank in the work of culture and education.

The same consideration will likewise serve to determine, as regards their mutual service one to the other, *what assistance* the memory should render to thought. *The memory has, indeed, nothing else at all in the wide world to do but to be of service to thought.* But, on the other hand, thought cannot make any progress unless the servant memory is continually at hand. Memory must, therefore, follow constantly at the heels of the master, and not lag behind, leaving the master to proceed alone.

It has frequently happened, in the history of education, that this relative rank of thought over memory has misled into a serious error with regard to their relation in service to each other. Thus, when many teachers esteem thought higher than memory, they are, of course, entirely right, in case this is meant merely as the relative rank of the two processes; but if in practice they neglect the memory, they are terribly foolish, — just as foolish as one who thinks he will gain his purpose without attending to the means of accomplishing it, or as a master who lets his servant starve, and still believes he will, nevertheless, receive good service. This error was long ago recognized, as indicated in the Jesuit maxim, "*repetitio mater studiorum est.*" This statement expresses a truth, but is very far from expressing the whole truth. Hence it does not seldom happen that those who like so much to quote this maxim fall into more numerous and worse errors in regard to thought and memory than the others do to whom these are so willing to give advice. These mistakes made by the partisans of memory will be plainly recognized if we now reverse the

relation, and consider the help afforded to memory by thought.

First in importance comes immanent memorizing (p. 106) — as distinguished from the intentional. Its superiority is owing on the one hand to the fact that this form makes use almost entirely of rational association, and on the other hand that it costs no time. The work of immanent memorizing is, indeed, accomplished by the industrious master "thought" — even in those cases in which it depends on an appropriate arrangement of the course of study. The servant, memory, does not need to move a finger, and yet afterward enjoys the fame with ignorant people of having done this fine piece of work itself.

Intentional memorizing is accomplished by repetition. Thought may here also, in case it is called upon, render important assistance by bringing under one conceptional view the ideas which otherwise would be associated only mechanically by repetition. This breathes into repetition the breath of life in the form of rational association. In what measure this is possible depends, of course, on the nature of the subject. Wherever the subject does not necessarily require a mechanical association, as for example in lessons for *thought getting* as opposed to lessons for *thought expression*, repetition may be made entirely rational. But even in the many instances where verbal commitment to memory is necessary, and where, therefore, mechanical association is unavoidable, the rational means of memorizing through logical disposition and questions may afford very desirable assistance. Nothing much remains, therefore, exclusively for the mechanical memory but the instruction in singing, if we except the occasional learning of names and numbers in the other subjects.

If we reckon together all the assistance rendered to memory by thought:—

1. the immanent memorizing—in the operations of thinking,
2. the exclusively rational repetition—in the study of facts, in arithmetic, etc.,
3. the assistance of rational association—in the case of verbal commitment to memory,

we find the surprising result that by far the greatest part of the work of memorizing is accomplished by thought, when the right method of instruction is followed. That implies, therefore, that memorizing, which in the mechanical form would be a subordinate piece of service, is thus changed into a noble and inspiring work, and thus brings with it all the other advantages before mentioned.

The mistakes in method, resulting from a perverted conception of memory and of its relation to thought, may be now clearly summarized.

1. The first mistake is in not being acquainted with immanent memorizing, or in not making sufficient use of it. This mistake occurs wherever the three *resp.* five formal steps in the acquisition of knowledge are not consciously or unconsciously followed, and wherever the principle of the correlation of studies is not recognized.

2. The second error, generally associated with the first, consists in ignoring the help afforded by thought in the case of intentional memorizing, or in not sufficiently making use of the former,—whether by neglecting the logical disposition, or the secondary questions, or the appropriate use of reading, or finally by committing all three mistakes at once,—in a word, by restricting one's self more or less to mechanical repetition.

3. A third mistake is one that those in authority have contributed to spread. It is the view that restricts the idea of memorizing to mean the commitment to memory of words only. In such case it seems not to be known, or else to be totally ignored, that first and foremost the ideas themselves, concrete and abstract, for which the words stand, must be memorized. It is furthermore not known, or else ignored, that not only ideas, but also feelings and acts of the will, yes, even actions, must be memorized chiefly through repetition. In the case of actions this memorizing is generally called habit. Neglect in this matter has especially serious consequences for the formation of character, but for the present we will restrict ourselves to the intellect only. The falsity of the view referred to appears not only in the material memorized, but as well in regard to the method of memorizing. For the confinement of the attention to the form of expression, to the exclusion of the material ideas, prevents of itself the proper appreciation of immanent memorizing. Nor is there much likelihood that such a one-sided view will make appropriate use of the means for rational association in repetition, but it will rather, on the contrary, prefer the mechanical way.

Both the first-named errors above alluded to characterize the work of *memory-cram*, wherever found. It neglects the use of immanent repetition, and ignores the means of rational association; or, in one word, it makes exclusive use of the mechanical memory. The third and last-named error, of restricting the idea of memorizing to mean the commitment to memory of a particular form of language, is not necessarily involved in cramming; but when the two are associated together, the resulting method is doubly bad.

A mistake of another kind is still to be mentioned here, which, however, is fortunately fast dying out. May we hasten the day of its burial! Wherever it is still alive it makes its presence known by special "exercises for memory," separate "memory lessons," and similarly separate "thought exercises," and thirdly, what is still very common, separate "object lessons." Indeed, all of these exercises, in many instances, have been incorporated into the course of study as if they were so many separate subjects of study. The origin of this mistaken notion is undoubtedly the false idea taught so industriously by the old psychology, according to which each class of mental phenomena or activities was ascribed to a separate faculty or power of the mind. Of course this is as smart as it would be in botany, for instance, to talk about a root-force, a tuber-forming force, a branching force, a tendril-forming force, a thorn-forming force, a leaf-forming force, a flower-forming force, etc., etc. It is, in fact, just what the old heathen mythology did, when it ascribed every different kind of phenomena in nature to a special and independent divinity. The psychological mistake of supposing there were independent mental faculties led naturally to the pedagogical one of supposing that, by exercising any of these faculties on one particular subject matter, they would be trained for use on *every* occasion, just as a knife may be sharpened by rubbing on one particular body, and yet may be used to cut any other substance as well. That this theory is a pure superstition might be seen without help of the new psychology, because it was well known and could not be doubted that an understanding of mineralogy did not produce an understanding of botany nor an understanding of zoölogy; that a mathematical understanding was far from

being a musical understanding as well; that the understanding of theology did not bring with it an understanding of pedagogy, etc. But false opinions grown old are difficult to eradicate, and the presence of the "object lesson" in many courses of study and works on pedagogy is a speaking proof of this fact.

In conclusion, the doctrine of this book may be thus summarized:—

I. *In school instruction the MEMORY is fundamental in its importance; but,*

II. *THOUGHT is the sole purpose, and at the same time the very best means, of doing the work of memory.*

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